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EDITORIAL NOTES.

With the View to Uniformity.

ON consideration, we are inclined to think the heading to the little "Miscellaneous News" article in our last week's issue, "Opposition to the South Suburban Gas Company's "Bill," was not an exact indication of the actual position. As a matter of fact, the intervention of the London County Council, and the support the Lewisham Borough Council are giving to the County Council's proposition, may be regarded as favourable to the Bill, and not inimical, as is suggested by the word "opposition." The main part of the proposal of the County Council has reference to the supersession of the illuminating power standard by a calorific power one, and, at the same time, to uphold the Company against any alteration, beyond concessions already made, of the terms as to price in the annexed areas, in view of the fact that further change would prejudice consumers in the existing South Suburban area, in which both the County Council and the Borough Council are concerned.

The proposal, however, as to a calorific power standard being substituted for the illuminating power one is the paramount feature of this late move on the part of the London County Council. The setting-up of a calorific standard and a penalty test, with the dethroning of the illuminating power penalty test, in the case of the Wandsworth, Wimbledon, and Epsom Company's Bill, is the actuating cause of this intervention, "with the view of obtaining uniformity," in the parliamentary career of the South Suburban Gas Bill. It might be—one cannot tell—some years before the Company are in Parliament again, though they never have hesitated to face Parliament when there was anything they desired in the interests of the undertaking and of their customers. There might not, however, be any occasion for them to again come to Parliament for some years; and this would defer, probably for a long period, the application of the calorific standard to them. Therefore there is no reason whatever why, if a fair calorific standard is suggested, the illuminating power test in their case should not be at once abrogated, and the calorific power one be adopted; and thus serve as another step in the interests of progress. This we do know, that there is no gas engineer or administrator who is more favourable to the general supersession of the illuminating power standard by a calorific power one than the Chairman of the South Suburban Company, Mr. Hunt. Since thermal value has become the quality of cardinal importance in the uses to which gas is now put, the necessity for change has become almost a principle with Mr. Hunt; and, as a matter of fact, in conjunction with Professor Frankland, he was consulted by the London County Council before the Gaslight and Coke Company's standard was imposed in 1909. Whether, however, with the experience gained since then, he is entirely favourable to the conditions of the Wandsworth calorific standard, it is impossible at the moment to say; but there is no question that those conditions are the ones the County Council have present in mind for application to the South Suburban Gas Company, "with the view of obtaining uniformity." The terms of the Wandsworth calorific power test in various respects, apart from the overthrow of the illuminating power test, are less cumbrous and awkward than those applying to the Gaslight and Coke Company; but a little trimming here and there would certainly be an improvement. However, the political change in gas affairs introduced by what happened in respect of the standard of quality in the case of the Wandsworth Company came too late for the South Suburban Company (their Bill having passed through the House of Lords) to themselves make any move in the direction of a similar change. But the County Council are in a position to intervene.

"With the view of obtaining uniformity!" These words appear to be full of import. If this is the commencement of a scheme to introduce a reasonable calorific standard and test throughout London, then not only the London Gas Companies, but the whole British gas industry will be interested in it; for in all statutory change connected with the testing of gas, the Metropolis has led the way in the making of history. But if the Wandsworth conditions and standard are to be taken as fairly applicable to London, then, "with "the view of obtaining uniformity," we may assume that recourse will be had to the earliest opportunity to lift from the shoulders of the Gaslight and Coke Company the dual penalty test, and allow only the calorific test to remain—the latter, too, being revised so as to bring it into line, or about into line, with that of the Wandsworth Company. The prospect of further early change is clear so far as the Metropolis is concerned; for the County Council have in latter years been almost solicitous over maintaining systematized gas standards and testings in London. A departure was made in regard to calorific power in the case of the Gaslight and Coke Company; but now it is seen that the County Council in connection with the Wandsworth and the South Suburban Companies are not desirous of maintaining the illuminating power test, whatever may have been their views when the Gaslight calorific standard and conditions were formulated. This change of attitude will considerably ease the path to change from the one quality to the other in other quarters in and about London, where the Administrative County of London district covers wholly or partially the gas-supply areas. The communication of the County Council to the Lewisham Borough Council makes it plain that the former have adopted a policy of uniformity in this matter, so that eyes may be kept upon London to see what will happen upon the start now given by the Wandsworth, Wimbledon, and Epsom Bill. There is just one thing that might be suggested to the County Council as bearing upon uniformity, and on the major view as to technical preference in this country. It is that, as in the case of Wandsworth, the gross calorific value be established, as favoured by the Metropolitan Gas Referees, and that such a hybrid stipulation as calories per cubic foot be suppressed. The cubic foot is a good British measure; and we are all content in the gas industry to deal in, and speak of, B.Th.U. If the authorities of the London County Council will assist in producing uniform British nomenclature for British gas undertakings at the initial stage of the change that is coming over the industry, the industry will be indebted to them, as there is no doubt that the lead given in the Metropolis will largely influence what is done throughout the British domains in this particular respect.

Incompatible Bases—Profit Appropriations.

THERE was a spirited discussion last week in the Nottingham City Council on the subject of the affairs of the Gas Department, and the occasion was taken to make further protest against the, to meet the general liabilities of the city, supertaxing of those ratepayers who support the gas undertaking by being its customers. To deal primarily with the first matter, a sharp criticism was made of the inability of the department to make a better current financial showing in respect of costs and average price in comparison with twenty-one years ago, notwithstanding that there has been an increase in consumption of nearly 60 per cent. in the meantime. The criticism was made by Mr. E. Harlow, a former Chairman of the Gas Committee, and made with the best of intentions; but we are afraid that we cannot accept the criticisms as being of substantial account, as they are fundamentally wrong. In the gas industry, 1890 cannot be compared with 1912. Everything has changed; and the changes have obliterated any parallel between the affairs of two such distantly separated periods. Coal and labour in many instances, and from year to year, vary the conditions; but repairs and maintenance of present-day plant, the distribution expenses, and management costs are —increased business notwithstanding—necessarily higher

to-day in view of the changes that have been effected by the progress of events.

The character of the plant within gas-works to-day, the character of the business of gas undertakings, the extension of the basis of the business over a lower average unit of custom, the obligation to provide so much more apparatus for fostering consumption and to maintain it, the increased costs associated with the running of a business with smaller average units of custom than with fewer larger units, all go to make differences that cause the years preceding these changes to be altogether incompatible for comparison purposes with current times. In the gas industry all this is well known; but it is necessary for the facts to be occasionally pointed out to critics who are not conversant with them. Five years after the year Mr. Harlow took as the basis of his comparison, the Electric Lighting Department of the Corporation commenced active business. Large individual and lucrative consumers were transferred from the one department to the other; their places, and more, have been taken by slot meter consumers, cookers, gas-fires, and so on. But these consumers cost more to supply and to look after, having relation to the volume of business, than the larger ones. We see that of the 78,825 consumers of the Gas Department, no less than 39,062 are now prepayment consumers. Where were these prepayment consumers in 1890? What differences have they made to the factors that bear upon Mr. Harlow's financial averages? To those consumers is largely due the increased distribution costs and management expenses. We see, too, that 22,025 of these prepayment consumers are supplied with cookers free. The trade and domestic uses of gas for heating have likewise all made their mark in changing the bases of comparison, and in causing sound depreciation charges to be heavier. As a set-off to the increased conveniences and charges, a somewhat higher price per 1000 cubic feet, according to the practice approved by Parliament, has to be charged to the prepayment consumer; and this has the tendency to make the average receipts per 1000 cubic feet of gas appear to be heavier. Upon all which considerations, the financial part of Mr. Harlow's criticism must fall to the ground.

The question of the increasing appropriation of profits in aid of the rates is another matter. As a principle of municipal practice, it has always been unsound; and, under the conditions of to-day, it is a positive degradation to municipal government. We strongly support such outspoken condemnation of the practice as that of Mr. Harlow and Mr. G. O. Richards, one of the representatives on the Council of the independent labour party. In 1903, the amount transferred in aid of the rates was £24,000, while this year it is £39,000, although to-day nearly half the consumers are prepayment ones, though admittedly the consumption of gas by them is only about one-third that of the ordinary consumers. An undertaking such as that of gas supply should be run so that it contributes directly its maximum service to the communal interests, without any external influence being brought to bear upon it that will repress this maximum service, which can only be done by selling gas at the lowest possible price consistent with the undertaking shouldering all its own responsibilities. The abuse of a liberty, and the growing abuse under modern conditions, is, as we say, a degradation to modern civic government; and we do hope that, as purely ethical considerations are of no avail, an end will be put by Parliament to the privilege, or, failing this, that Parliament will adopt the 1 per cent. restriction on outstanding capital proposed some time since by Lord Donoughmore, the present Lord Chairman of Committees.

We can only treat with contempt the old parrot-cry of the defenders of municipal appropriation of trading profits —defenders such as Mr. H. G. Ford in the Nottingham City Council—that the ratepayers are practically shareholders in the gas undertaking. How so? What have they done to deserve any consideration *quâ* ratepayers? Have they subscribed any money by way of capital out of their own pockets? Have they, or have the gas consumers, met the obligations of sinking fund and interest? Have they, or have the consumers, found the money to maintain the undertaking, and to renew and even extend it? Have they, or have the consumers, paid the rates and taxes on the undertaking? What have they done, we ask again, to have entitled them to pick from the pockets of the consumers of gas £300,300 in the short space of a decade? We suggest to Mr. Ford and his like that they should call a spade a spade, and the fleecing of gas consumers a miserable disgrace to municipal management. We are perfectly willing to consider any case that Mr. Ford, or others who think with him, can put forward that will show any substance which has been contributed by the ratepayers entitling them to be called shareholders in the gas undertaking, and which can be set alongside the financial substance borne and contributed by the gas consumers since the undertaking became a municipal possession. But we shall not call substance the hoary effete platitudes that municipal appropriators have trotted out for duty ever since this question came into the arena of civic politics.

A Practical Address—Coal Points.

The address that formed the groundwork for the discussion at the meeting of the Waverley Association last week was delivered by Mr. J. W. Napier, of Alloa; and it was full of pithily-stated practical wisdom. In the forefront, we have the truism, there is no finality in the gas industry. And no finality can there be while the industry keeps along the highway upon which it has been carried by events, and so long as its affairs are mainly directed by technically-trained minds—minds capable of being moulded to the changing circumstance, and minds that can readily detach themselves from the consideration of one subject and pass to another. In the address, the power of ready detachment of the mind from one subject, and the transfer of consideration to another, with practical judgment and effect, is seen; for in it we are brought to the consideration of several subjects in technical management, and to each Mr. Napier gives practical point from his own experience. He discusses, among other things, the question of the relative advantages of pipe enlargement or boosting where supply and pressures are deficient; and the simple means by which the latter can be accomplished from the gas-works—more especially as the boosting is only required during the hours of lighting—appeals to him as being the more politic and economical. For the lighting load, he advocates a pressure of 3½ inches; and his observation and experience warrant him in saying that the practice removes grievances and promotes satisfaction. Many gas managers will be inclined to disagree as to the necessity of 3½ inches; but those who think 2 or 2½ inches sufficient for present-day conditions will on the morrow be with Mr. Napier.

There is the question of coal stocks. Notwithstanding recent experiences, Mr. Napier thinks that six weeks' maximum stock is sufficient; and that those who talk of three and four months' supply have allowed their ideas to have a little hyperbolic play. It is hardly possible to agree with Mr. Napier that the old prescription, under conditions that no longer exist, can be safely applied. Labour policy is not what it was; and we have to face the contingency, when funds are in the hands of the Unions, of national strikes of miners or of transport workers. It is not only to the labour conditions at the sources of supply to which the large user of coal has to look to-day, but he has also to keep an eye on the means of covering the distance between pit and works. The labour world is in the grip of a different kind of generalship from what was the case but a few years ago. These are considerations. And when Mr. Napier speaks of a six weeks' maximum stock, he is naming the duration of the last stoppage, which might have occurred in the period of maximum requirement in the gas industry, and will no doubt do so if the threats of the leaders are fulfilled, should they determine to fight again. Not only was the stoppage one of six weeks' duration, but several gas-works began to feel the pinch of short delivery, owing to the scramble for coal, before the complete stoppage occurred; and we have knowledge of works in the southern part of the country that did not receive deliveries again until nearly three weeks after work was resumed at the pits.

Of course, coal stocks cost money; so does the purchase of coal when supply is not equal to demand. We know of gas-works, too, that, through want of prevision and provision, had to pay, owing to the strike, double the price for coal that it would have cost them if it had been put into store when there was the opportunity. The managers of these works will not again be found treating the prospect of a coal strike with contempt. Those managers and many managers in some parts of the country who did not receive an ounce of coal for about nine weeks now take the larger view, though not perhaps to the extent of a three or four months' supply. Another effect of the strike too has been to cause water-gas plants to be talked of, and looked upon, as valuable adjuncts. They have gone higher than ever in the estimation of those

who had paid them some regard before owing to their "col- "lateral advantages." There is also the question of the current contract prices of coal. Many contracts for the year have been concluded; but the strike and prices have deferred the closing of many. Advances of 2s. 6d. and 3s. per ton are spoken of as being among current quotations; but we have heard of contracts concluded at 9d, 1s. 3d., and 1s. 6d. advance on last year's rates. Under new contracts large bulks of gas coal are going out of the country at advances on last year's prices of 1s. 3d. If 1s. 3d. increase suffices for abroad, there is no reason why larger quotations should be pressed at home. So far as current trade circumstances go, there is no justification for any such advance as 2s. 6d. per ton for twelvemonth contracts.

Another interesting point raised by Mr. Napier is the basis of the valuation of coal for carbonization purposes for the production of gas and other commodities. He thinks that the "other commodities"—coke, tar, and ammonia—in view of their higher commercial value in these days ought to receive greater consideration than hitherto in assessing the value of coal. In fact, if the utmost revenue is to be obtained from the ton of coal, the moisture in coal when purchased should also be determined, as it varies largely in its percentage in different coals. The water content of coal is a characteristic that can be determined with a fair amount of accuracy; but the moisture-absorbing capacity of some coals may materially alter the condition in respect of quantity of water between pit and the time of its determination at the gas-works. Of course, the difference in weight between pit and destination would show whether there had been any material change in this respect. In the quest for the largest possible profit *viâ* the residuals from the ton of coal, Mr. Napier further points to consideration being given to the breeze-producing capacity of the coke under the conditions of coal carbonization, and he directs attention to the improvement in the value of coke from the coal that he uses at Alloa when carbonized in vertical retorts, compared with horizontal working. In seeking to obtain further return from coke, the proper regulation of the producers of retort-settings will contribute to that end by the savings effected. Mr. Napier would make a very serious business of the assessing of the value of a coal in respect of its secondary products; and coal being the industry's raw material, and at the base of all its business, he is right.

Domestic Hot-Water Supply.

One of the protagonists of central water heating in this country, or, in other words, the distribution and supply of hot water, just as cold water is distributed and supplied, is Dr. Herzfeld; and recently he was reading a paper on the subject before the Sanitary Institute. He put forward a good case against the continuous coal fire as an economical system of meeting intermittent requirements for hot water. Reckoning the consumption of fuel between the periods that hot water is needed as stand-by expense, and taking into account labour and nuisance, it is not at all difficult to make out a good case for an alternative system of providing hot water; and the best alternative system is indubitably the ever-ready-to-serve gas-heated water appliance. For his central water-heating system, Dr. Herzfeld puts forward a lot of theoretical calculations based on hypothetical circumstances, for not one of which can he pledge any stability or permanence. This is so much the case that it is really scarcely worth while to discuss them.

For example, for the figures to work out in exact accord with the estimates, a definite number of householders year in year out must pay a definite rate per annum for the hot-water service. Householders change their residences; and the new householders may prefer to provide their own hot water when and as required, at what temperature they like, and pay only for what they have, instead of having a fixed rate to meet and a fixed water temperature to receive. Householders who are attracted by the system in the first instance may not find themselves so enamoured of it after a time; and every consumer who withdraws his patronage would alter the conditions for the undertaking. There are contingencies of this kind to take into account. There is the contingency of the changing character of the residents in the places supplied. The factor of permanent patronage is not sufficiently considered by the Doctor. Again, there is the contingency of waste; and many other things that may upset the careful compilation of Dr. Herzfeld on assumed set and unalterable circumstances. And there are also the questions of loss of temperature, of upkeep, and of the delay in perfecting the financial position while waiting for business to "turn up"—not one of which conditions can be regarded in any light as certain. The same applies whether a plain hot-water distributing system is undertaken, or whether it is conjoined to an electric-supply service. On Dr. Herzfeld's present inelastic figures and circumstances, we should not like to invest money in such a highly problematical venture.

The Doctor was extremely guarded in not paying too high compliments to the heating of water by gas methods, whereby the large or the small requirements of houses are instantly met at small expenditure, and no more expenditure than the equivalent of the service demanded and rendered. He said it must be admitted that water-heating gas appliances have reached a fair degree of perfection. The tone is seemingly that of unwilling testimony. The general experience is, he adds, that these appliances require skilled handling, and that they cannot safely be left in the hands of any but conscientious people. The very words prove inexperience or personal hostility; for they are diametrically opposed to all the large growth of experience in modern years. The heating of water by gas is an economical process; and by using the right appliances, getting exactly what one requires in the way of temperature, and paying only for what one has, and withal no necessity to have a fresh conveying system installed in the house, neither in cost nor in a perfect convenience—the convenience of variable temperature water—can a central system such as that advocated by Dr. Herzfeld claim equality. That, in effect, was what Mr. F. W. Goodenough and Mr. Potterton endeavoured to impress upon him during the discussion.

Some Further Good Reports

There are noticed to-day some further reports, which show good working results of gas undertakings in the hands of local governing authorities for the financial year to March last. A profit amounting to £9618 is announced at Bradford, as compared with £12,935 for the preceding year—a result which is considered satisfactory, having regard to the manner in which the Committee were handicapped during the coal strike. The income from the sale of gas exhibits a trifling decrease; while, on the other hand, coal cost a good deal more, and wages were substantially increased. Nearly 1¼ per cent. more gas was sold at Brighouse, where there is a net profit of £2125. The net cost for coal per 1000 cubic feet of gas sold during the year was less than 1½d. The sales of gas were appreciably larger than in the preceding twelve months at Hinckley; and the net profit is £3635. In fact, it is pointed out that the profits made and the quantity of gas consumed constitute records in the history of the undertaking. The price of gas has been reduced; and a useful sum has been transferred to the general district fund. At Lincoln, instead of an estimated amount of £1838, there is £2141 to carry forward. The gross profit, at £15,558, compares with £15,966 for the previous year; while the net profit of £7855 is about £300 less than a year ago. It has to be remembered, however, that a reduction in the price of gas reduced the income by some £900; while the restriction of the supply during the coal strike entailed a further reduction of revenue. Large sums have been spent in repairs and maintenance.

From Municipal Gas Undertakings.

The balance which is shown on revenue account at Loughborough is much larger than ever before—£8309, or £650 more than for the preceding year. The plant, it is stated, was worked with increased efficiency; and the consumption also increased substantially. During the "lean" years, when the department did not pay its way, certain sums were found by the district rate; but this amount has now either been repaid, or can be at any time. The past year at Market Harborough has been the most successful yet recorded, both in respect to working and finances; and the increased make of gas and sale of coke per ton of coal carbonized are stated to be due to the improved results obtained from the new chamber retort-setting. The net profit of £1042 compares with £933. There is an increase of over 6 per cent. in the quantity of gas sold; while the average make of gas per ton of coal carbonized was 12,968 cubic feet, against 12,150 feet for the year before. Another record

has been established at Stockport, where the net profit of £26,657 compares with £26,192 last year. At Warrington the net profit of £16,367 is an increase of over £5000 on the preceding twelve months. At West Bromwich, the revenue shows a very satisfactory increase; and there is a net profit of £5839. Of this sum, £2854 is to be transferred to extinguish the balance on the extensions suspense account, £500 has already been voted in aid of the district rate, and the remainder will be carried forward. Some statistics submitted to the Council show clearly the excellent progress made by the undertaking during the past ten years.

Another Impudent Prospectus.

A prospectus has been privately circulated by the two Directors—Mr. E. Nussey and Mr. H. Hollis—of the Weald District Gaslight, Coke, and Coal Supply, Limited, which Company was unrepresented in the Law Courts last week in an action for the recovery of £208 for coal supplied. For the magnificent character of the temptations held out by it, and the absolute lack of any authentic figured information as to how the Company is progressing, the new prospectus ranks among the worst issued in the palmy days of the promoters Eaton and Preston. The object of private circulation, a covering letter states, is to save the expense of a public issue; and, if application is forwarded within four days of the receipt of the prospectus, the Board kindly promise to give preferential consideration for allotment to the application. The public, we hope, will regard the baits and absence of information as warnings. We remember Mr. Nussey was associated with the Natural Gas and Petroleum Company; and his name and that of Mr. Hollis appeared on the Weald prospectus issued in February, 1911, which prospectus, we are pleased to see, did not attract the public. The capital was then stated to be £6000—divided into £3000 "8" per cent. preference shares, and £3000 "unrestricted as to dividend" "B" shares; and of this £1250 was reserved for future issue. It seems that the public assisted in reserving much more than that for future issue, for only 541 "A" shares were allotted (250 of which were treated as fully paid), and 184 "B" shares—the amount of cash received in respect of the allotment of shares being only £438. There is a first charge of £240 in debentures; £500 debentures have been fully-paid under the contract for purchase; while £100 debentures have since been issued. The first two sums it is proposed to redeem out of the new issue of debentures.

Present Requirements and Prospects.

Now the Directors would like the public to put them in possession of considerable funds. They suggest the issue of £2400 preference shares, ranking for a cumulative and immodest preferential dividend of 8 per cent.; £2800 "B" shares (these are the "unrestricted as to dividend" class); and £1400 5½ per cent. mortgage debentures. These mortgage debentures are interesting, for the external gilt has been piled on with unsparing hand. Five-and-a-half per cent. debentures! to be issued at £80 per cent.!! and three months' interest to be paid on the 25th inst.!!! Moreover, they are to be redeemed, at £11 for every £8 paid, on Jan. 1, 1919, or sooner at the Company's option. The Company want the public to promptly confide to its keeping as much of the money as possible; and so 50 per cent. of it has to be paid on application, and the balance on allotment. This will, of course, save the public a lot of trouble. We should have liked to know something regarding the relative prospects of the debenture stock, and preference and ordinary share holders, as to receiving interest and dividend. The prospectus does not inform us as to what has been the result of the business done since the February, 1911, prospectus was issued, which latter was well sprinkled with the glorious potentialities of the Company. All the information is that the consumption of gas shows "steady progress." We should have preferred seeing the "steady progress" rendered into definite figures. An increase in output is "proposed" by the Directors; and what they now propose is estimated at about 50 per cent. increase. "Increase," on what? Nearly eighteen months ago, it was stated that it was believed the South-Eastern Railway Company would become customers as soon as the main was extended to the station; but negotiations do not appear to have got far, as the "believed" is now altered to "no doubt." The works are situated at Crowhurst Bridge, Burwash. This fact does not appear to be mentioned in the present prospectus, or at any rate it is not so prominently stated that it has caught our eye. It is not upon the "estimated" 50 per cent. increase in gas consumption alone that the Directors are relying for the money to pay interest and dividend; because they are going to cultivate a sort of co-operative coal-supply business, by establishing depôts at Brighton, Hastings, Eastbourne, and Bexhill. The shareholders who are fortunate enough to live in these districts will be able to obtain their coal and coke supplies at wholesale co-operative prices, and at the same time participate in the profits, and insure themselves against inflated strike prices. The whole thing appears to us, in view of the amount of capital asked for, as an impertinent scheme. If, unfortunately, the Directors were successful in getting at the present time the whole of the capital they are suggesting, where is the money to come from to pay the interest and the dividend? The public, we hope, are not so short-sighted as to subscribe such sums of money on an empty prospectus and uncertain prospects. We do not observe the name of the Company's Bankers; but to the application form there is appended a "Bankers' or Company's Receipt Form."

The National Campaign.

The "Advertising World" for May gives the gas industry and the British Commercial Gas Association a hearty pat on the back for what is being done in the way of a national advertising campaign. The article presents a strong case for combined effort. It points to the struggle for favour between gas and electricity as providing one of the most interesting spectacles in the industrial world to-day; and the piquancy of the situation, we may submit, is enhanced by the economic difficulties of the electrical industry in opening new ground as contrasted with the comparative ease with which it can be done by the gas industry through the superior heating quality of town gas. Comparing the two industries, our contemporary has no hesitation in saying that, in this particular campaign, the gas industry can claim nearly all the honours. The leading companies, in combination, as well as individually, have issued a great amount of exceedingly well-devised advertising matter, and have called every variety of medium into their service. In the Press, they have, for a considerable time, been represented constantly in all classes of publication, by strongly suggestive, persuasive, and argumentative advertisements, addressed to every possible description of consumer; and this active advertising has had a powerful effect. The case of every commodity, it is held, must be argued in the open, so that the court—in this case, the gas-consuming public—can judge for itself. This can only be done by an organized advertising campaign on a national scale. The money spent on this is infinitesimal in comparison with the interests at stake. These are only an indication of a few of the points from a long article. It is interesting to have this testimony from a disinterested source, which is evidence that what the gas industry is doing attracts the attention of others outside its own pale. It is sometimes good, too, to learn how others see us, when those others give an unprejudiced view, as in this instance.

Compressor Driving by Electric-Motors.

In the "JOURNAL" for Dec. 5 last (p. 673), an article appeared headed "Petty Vindictiveness," in which was discussed the absurd treatment meted out by certain electricity suppliers in London to the owners of business establishments who use electricity for driving motors for gas compression for high-pressure lighting. Not a few people are so employing electricity; and the annoyance and vindictiveness of some Metropolitan suppliers of electrical energy have induced them to insist upon charging these users lighting rates for the current, and in some instances maximum rates, though power prices are charged to other small motor users for other purposes. In one instance, there was a firm who employed quite a large number of motors for industrial purposes; and the motors were supplied at 1¼d. per unit. But the firm had a preference for lighting their premises by high-pressure gas-lamps; and they also adopted an electric motor for the compressor. The Electricity Supply Company at once placed the price of the energy for this motor at 5d. per unit., as compared with the 1¼d. the firm were paying for the current for the other motors. Never, we should think, has anyone heard of a sillier or more childish action on the part of any industrial concern. The firm refused to pay more for energy for driving the compressor than they were doing for that for the other motors; and, for a long period, the Company have been claiming the arrears, which the

firm as consistently declined to recognize. The Electric Company have at length given way, and have abandoned the claim, and conceded the position to the firm in question. We do not think any electricity suppliers would care to take a case like this into Court, and there have to face the irreconcilable positions of supplying (say) a small motor for driving brushes at a hairdressers' establishment, and of declining to supply a similar motor at the same price per unit for gas-compressing purposes—merely because the gas was required for competing lamps. The law behind which the London electric suppliers take refuge in respect of this matter (although there has never been a test case to ascertain if this is the proper interpretation of it) does not apply to the Provinces. Whether the General Law or Private Acts cover the matter outside London is quite another question. We doubt the General Acts. When they were passed, little, if any, thought had been given to the employment of electric motors for gas-compressing for lighting purposes.

Wiring and Hiring.

From the notices in the parliamentary papers last week, it was gathered that the Canterbury Gas and Water Company, the Swansea Gaslight Company, and the Taunton Gaslight Company had withdrawn their petitions against the National Electric Construction Company's Bill. This Bill, it will be remembered, is the one by which the Company propose to legalize agreements with certain electricity-supplying local authorities, and so obtain statutory sanction to their action, under which the Company have been allowed to wire houses, the local authorities making themselves responsible for the collection of the rent for the accommodation by charging an extra price for current, and handing the excess over to the Company. In this, the authorities appear to have been acting *ultra vires;* for it is simply an evasion on their part of the non-possession of powers to wire. The Gas Companies referred to have, it seems, arrived at a settlement with the promoters of the Bill, which, we believe in effect, confines the operations of the agreements entered into with the local authorities to work already done—that is to say, it restrains the promoters from getting the benefit of any further extensions under the agreements. It was the Gas Companies' Protection Association who took this matter in hand; but as individual companies showed great apathy in the matter, no doubt the Association felt they had carried it as far as they could. However, the result of the action of the Association was that the gas companies secured substantial advantage from their opposition on Standing Orders before both Houses; and the limitation now effected—we suppose it will be only in the specific cases referred to—is the result.

A Suggestion and the Response.

Among the varied assortment of recent contributions to the Press on labour subjects, certainly one of the quickest to have practical effect was a communication to the columns of the "Western Mail" by the Bishop of Llandaff, on the causes of labour unrest. The writer did not confine himself to seeking out the causes, but went on to deal with the remedy. Admitting that the most hopeful solution seems to be one or other of the forms of co-operation or profit-sharing, he asked why, as the South Wales Miners' Federation had some time ago a reserve fund of £150,000, they should not set aside £10,000 of this for investment in ten different collieries—£1000 in each. Subsequently further sums could be invested—not necessarily in the same collieries, but in those undertakings which were found the best—until the Federation had acquired by fair and honest means a controlling power in one or two large and successful collieries. In the very next issue of the paper a report appeared of a statement by Mr. D. A. Thomas, the Chairman of the Cambrian combine, in which he outlined a system of co-partnership for Welsh miners. While of opinion that co-partnership would not work out successfully in mining concerns, he said he was prepared to give it a trial; and in connection with certain new pits, a portion of the capital (£10,000) would be reserved for the workmen. An easy plan would be arranged whereby this capital could be subscribed, so that he hoped those engaged at the mine would participate in the profits. He emphasized the fact that all businesses require a strong guiding power at the head, and that difficulty would immediately present itself if there were diverse policies represented on the directorate. It is evident that Mr. Vernon Hartshorn, Miners' Agent, from his particular point of view, is a strong disbeliever in profit sharing and co-partnership; for, in an equally prompt response to the Bishop of Llandaff's suggestions, he maintains that co-partnership "is a form of compulsory thrift, whereby a man's savings come largely under the control of his employer. It makes for bondage, because it ties up the workman to the industry in which his meagre savings are invested, while giving him no real controlling power over that industry, and it makes him less aggressive as a Trade Unionist." Where is the root of the objection in this statement? It is a simple plan that is contemplated by Mr. Thomas; and it will be interesting to watch the progress of an experiment in which neither party displays any great amount of confidence.

Sulphate of Ammonia and Nitrate.

Upon the fortunes of the sulphate of ammonia market, the position in the nitrate market has a bearing. This being so, with present prices for sulphate of ammonia on a good scale, the producers will be pleased to learn that events have been coursing in such a way in the nitrate industry that there is a prospect of the higher prices now ruling for nitrate being maintained. The splitting-up of the combination in the industry, which combination restricted output, has proved to have been a happy circumstance for nitrate producers; and there seems to be no chance of the combination being set on its legs again, and fictitious conditions being created. The producers find that the demand for nitrogenous manures is growing, and that it keeps pace with output. This equilibrium is satisfactory, as it promises higher prices in future. The current year's nitrate prices are expected to show an average higher than for 1911, with an increased consumption. The position must reflect itself upon that of sulphate of ammonia, and assist in maintaining its strength, just as the present position of sulphate of ammonia is helpful to nitrate. Stronger positions on both sides must act reciprocally in producing benefit.

PERSONAL.

At the meeting of the Wigan County Borough Council last Wednesday, Mr. Fred Betley was appointed Gas Engineer and Manager, at a salary of £300 per annum, in succession to the late Mr. Joseph Timmins.

Mr. Charles Loveridge, of the Wallasey Corporation Gas and Water Department, has been appointed Manager of the Wolstanton United Urban District Council Gas Department. There were over seventy applicants for the position. Mr. Loveridge has been at Wallasey for a lengthy period as chemist and draughtsman, and latterly has acted as technical assistant to Mr. J. H. Crowther, the Corporation Gas and Water Engineer. Mr. Loveridge passed with honours in "Gas Engineering" and "Chemistry" in the City and Guilds of London Institute examinations; and, in addition, he has certificates in other subjects.

Mr. W. H. A. Chester, Assistant Gas Engineer to the Nottingham Corporation, has been appointed Engineer and Manager of the Middleton Corporation Gas-Works, in succession to Mr. C. F. Broadhead, who recently accepted the position of Manager to the Brisbane Gas Company. The commencing salary for Mr. Chester at Middleton is £250 per annum. Like his predecessor there, Mr. Chester was trained by Mr. J. H. Brown, who until some months ago was Gas Engineer to the Nottingham Corporation, and is now Engineer and Manager of the Gas-Works Department of the Simon-Carvès Bye-Product Coke-Oven Construction and Working Company, of Manchester. One of the chief reasons advanced for the appointment of Mr. Chester to Middleton was that he would continue the same line of policy at the works as was followed by Mr. Broadhead.

Gas Workmen and the Insurance Act.

Those of our readers who have studied the National Insurance Act may remember that the sixth schedule gives a list of insured trades for the purposes of Part II. of the Act. They comprise building, the construction of works, and vehicles, shipbuilding, mechanical engineering, iron founding, and sawmilling. The Board of Trade have issued a provisional list of workmen who, in their opinion, will come under this schedule; and almost all those employed upon gas-works are included. The matter is regarded as so important that it has been taken up by the Committee of the Gas Companies' Protection Association, who held a meeting last Thursday to consider it. It was attended, by invitation, by Mr. Charles Carpenter, Mr. D. Milne Watson, Mr. Stanley H. Jones, and Mr. F. J. Bradfield. In the result, the matter was referred to a Sub-Committee, consisting of the Chairman of the Association (Mr. H. E. Jones), Mr. Charles Carpenter, Mr. D. Milne Watson, Mr. E. Allen (Liverpool), and Mr. G. Clarry (Cardiff); and it was decided to invite the Institution of Gas Engineers to nominate two representatives upon it.

THE INSTITUTION OF GAS ENGINEERS.

ANNUAL MEETING, JUNE 11 to 13, 1912.

PRESIDENTIAL ADDRESS DELIVERED

BY

MR. R. G. SHADBOLT, of Grantham.

Gentlemen,—In addressing you to-day, it is not my intention to occupy your time by any descriptive dissertation on the town and undertaking with which I am the most closely associated, as there are other subjects of wider interest to the industry. Suffice it to say that, in our circumscribed area, and under our own peculiar conditions, we at Grantham discharge our duties to consumers, employees, and stockholders to the best of our ability, and, as we think, in the best possible manner. Any other references will be simply to point an illustration or confirm a statement, opinion, or idea.

THE IMPORTANCE OF THE ENGINEERING SIDE.

It is often said, and with great truth, that few industries are carried on under a greater variety of conditions than is the gas industry; and it is possibly due in a large measure to this diversity of conditions that we as gas engineers find so many sides to almost every subject brought into the arena of discussion, and become so tolerant of views other than those held by our individual selves. Yet, withal, no industry is supported by a more solid consensus of opinion among its responsible administrators and officials in matters fundamentally essential to its welfare or to the interests of the great public it is called upon to serve.

An industry charged with a public service of such magnitude and importance as is the gas industry, presents many phases, both to administration and executive; and not unnaturally the query is often heard as to which of these various phases its success is most generally attributable. We know, for instance, that inept financing will neutralize the best efforts of both technician and commercial man; and, indeed, any one department has it within its power to seriously discount the efforts put forth in other quarters of the same undertaking. To achieve the maximum of efficiency, it is but a truism to say it is essential that all parts must work harmoniously together to the common object. Speaking as one who is personally charged with all executive offices of a gas company's undertaking, and consequently favourably placed for forming an opinion as to the respective bearings of each office or department upon the whole, I am more than ever confirmed in the belief that the engineering side, in its fullest sense, must ever remain the bedrock of successful operation throughout our industry; and despite the fact that of late years there has been quite an awakening as to our commercial obligations and privileges—an awakening which, in the very nature of things, marks a new era in our methods and activities—the engineer is, more than ever, the basis of all successful operations.

Qualifications of a Gas Engineer.

Like other great industries, our own is evolving its own type of engineer, who, in obedience to the law of natural selection, and generations of progressive culture, is becoming more and more responsive to the manifold demands made upon him. Our veteran colleague Mr. H. E. Jones is most desirous that a considerably larger proportion of our number should seek the hall-mark of the Institution of Civil Engineers, and is greatly gratified at the sight of a batch of gas engineers gaining admittance at the discriminating portals of the "Civils"—quite a laudable desire and object in itself, but of little service to the gas industry unless intimately associated with other qualifying features. The requirements of the industry demand that the modern gas engineer shall be something more than is generally understood by the word "engineer." A technician of the highest order possible, is the best of groundwork; but to operate successfully he must be somewhat of a financier, with a shrewd idea of the monetary results of his proposals. Continuous everyday working results arising from his decisions and designs must be prominently kept in view; and the commercial possibilities—amounting almost to instinct in many cases—must be a controlling factor. These things, and more, the industry demands of its engineers, while at the same time providing them with the requisite schooling and groundwork for future enlarged applications. Or, to put it in another way, the gas engineer should be in and of the industry.

The Scope for Ability.

Never was there greater scope for the highest abilities and attainments, than is offered at the present time, from the handling of the raw material to the meeting of the latest requirements of the consumer; and full play will be found for all the powers of inventiveness, originality, selectivity, adaptability, and business acumen. It is not given to every engineer to be also an inventor—possibly a most wise provision. Yet the senses of proportion and perspective are absolute essentials, and in conjunction with the faculty of selectivity ofttimes produce the soundest engineering results possible.

Choice of Carbonization Processes.

And what a field for selection the gas engineer has at his disposal to-day! Let us glance first at manufacturing processes. Not many years since, it could justly be said that invention in coal-carbonizing methods was practically at a standstill. But what a change has come o'er the scene—as witness the proceedings at the last annual meeting, which will long stand out pre-eminent as the carbonizing meeting. To the ordinary managing engineer who is on the point of extending his generating plant, the selection before him is almost bewildering in its variety of method and rivalry of claim; and if he be not endowed with the sense of proportion and adaptability, as well as with an appreciative understanding of the merits and demerits of the different claimants to his suffrage, the probability is that a mistaken decision will be arrived at, from which his undertaking may suffer for many years. There is, however, one saving feature in this regard—namely, that the advent of the vertical retort in its various practical forms as an economic gas-producing unit has also quickened insight into carbonizing methods generally, and the reflex action upon older systems has been most beneficial. Nothing has of late, I think, demonstrated this more clearly than the work of Dr. Davidson at Birmingham; and he and the gas authorities of that city deserve our congratulations and thanks for the carefully compiled statistics they have so freely published, and the painstaking manner in which they are utilizing their opportunities to submit to work-a-day tests almost every carbonizing method known at the present time—including coking ovens.

Yet, with it all, there will be much left for the individual engineer to collate and analyze for his own particular guidance; and to render the matter more complex still, some of the features presented by the more modern methods are of such a nature as to be difficult of computation in terms of value. For instance, take the claims of the vertical retort. The lowering of sulphur compounds is readily reduced to money value. But the naphthalene and nitrogen claims are of an entirely different character; and the appraising of their value depends altogether upon existing practice and general results. The advantages accruing from the reduction of labour costs in the working of vertical retorts, through the utilization of mechanical appliances, do not pass unchallenged by combinations of older systems with equally modern adaptations; while, yet again, the value and character of the residual products are of too important a nature to be allowed to go unheeded. Ease and regularity of working and adjustment, maintenance and renewals costs, output per unit of plant, initial capital expenditure, and adaptability to immediately surrounding plant, are all factors which the resident engineer who is peculiarly responsible for the working results of his own recommendations cannot afford to ignore, and which call for the exercise of the various qualities I have attempted to enumerate. Never was such a rich selection ready to his hand; and never were greater

care and discrimination required in the making of so vital a selection.

Varying Practice with Other Plant.

In condensing, washing, scrubbing, and purifying processes, there is unmistakable movement among the dry bones; and in many particulars regarding these things each man is a law unto himself. I know of nothing more interesting than quiet walks round a variety of works, and learning why, for instance, A keeps up the temperature of his foul gas as high as he possibly can (even, in some cases, raising it by means of steam tubes, coils, &c.) until the condensers proper are reached, while B commences the reduction of temperature at the earliest possible moment, and probably extends it as much as practicable. Also, why C has come to the conclusion that the foul gas and condensate streams should run in opposite directions, as against D's experience of benefits derived from allowing both to meander together in the foul main. And, yet again, as to the advantages obtained in other cases by means of reversible condensers; and so on. But with all this, agreement as to the main functions of condensation, its limitations and effect upon subsequent treatment of the gas, is much more general than formerly, resulting in greater controllability of condensing appliances—as in the growing use of the water-cooled types, and the separate treatment of gas for the removal of tar and tar vapours which mere reduction of temperature fails to effect.

In washing and scrubbing methods, the aim of the engineer generally is to obtain the maximum of efficiency with the minimum of space and resistance; and the various applications of scrubbing and washing treatments as distinct from each other, and also combinations of the two, are too familiar for detailed reference. Suffice it to say that, popular as machine washing and scrubbing plant has become, there are not wanting in some quarters signs of a return to favour of the less drastic, but more leisurely, and possibly more effective, tower-scrubber. The application of centrifugal treatment to the washing, scrubbing, or purifying agent is also making advances; and, in common with carbonizing methods, all purifying processes, from the hydraulic main to the station-meter, are showing unmistakable signs of development, and in numerous directions.

Removal and Recovery of Ammonia.

To revert to condensation for a moment. Modern methods for the removal of undesirable constituents from the gas make the taking-out of the last traces of tar imperative—hence the growing use of frictional systems as a supplement to simple condensation. This *desideratum* having been achieved, it is but a short step, theoretically, to displace the washer or scrubber, or both, by the acid saturator, and so effect the removal of the ammonia direct, without the intervention of scrubbing plant and still. The extraction of ammonia in this way is found quite practicable in coke-oven working, and does not appear to present any insuperable difficulties of application to town-gas plants. Certainly, the sulphate of ammonia salt produced is of fine appearance—not quite white, but with a good ammonia content.

The Burkheiser process, you will remember as being one which inspired great expectations as to its applicability to town-gas manufacture. These received some little set-back from an untoward occurrence in a certain instance. Nevertheless, it is still finding adherents, and will very shortly be working in this country on a fairly representative scale, of which we may learn more in due course. This, and the process previously mentioned, may be taken as typical direct ammonia recovery processes—the first by absorption of ammonia and the direct precipitation of sulphate of ammonia salt, and the latter by the utilization of sulphuretted hydrogen to form free sulphur, and from thence to sulphur dioxide in place of fully developed sulphuric acid. The resultant salts naturally differ in composition—the first being practically normal sulphate of ammonia, while the second is a combination of about two-thirds sulphate and one-third sulphite of ammonia.

Another process, associated with the name of Dr. Walther Feld, has undergone simplification in its latest form, and provides a most fascinating study. Originally designed for use in the treatment of coke-oven gas, it would now appear to have made a decided advance in town-gas works practice. The process utilizes a portion (from one-third upwards) of the sulphuretted hydrogen naturally contained in the gas for the purpose of abstracting the ammonia; and this also is effected without the employment of sulphuric acid. In his earlier process, Dr. Feld introduced metallic salts as binding agents; but he now claims to be able to bind the sulphur and ammonia by salts contained in the gas liquor as ordinarily produced. After the removal of all pitch and tar, the gas is treated in a special scrubber with a solution of concentrated gas liquor and sulphurous acid, which solution is capable of absorbing both sulphuretted hydrogen and ammonia—the reaction forming thiosulphate and sulphur.

The second stage is reached by again adding SO_2 vapour, and thus restoring to the solution its ability to once more absorb sulphuretted hydrogen and ammonia. The circulation of the solution through the sulphiding vessel and scrubber, thus absorbing alternately sulphur dioxide and sulphuretted hydrogen and ammonia, is continued until a sufficient degree of concentration is reached, when a portion is drawn off and heated to boiling-point in a separate vessel—resulting in the formation of ammonia sulphate in solution, the precipitation of molecular sulphur, and the vaporizing of sulphur dioxide, which is brought back for use in the process.

The precipitated sulphur, after the solution is drawn off, is filtered, dried, and burnt to sulphur dioxide, for use in the process. The mother liquor is subjected to evaporation, and sulphate of ammonia salt is precipitated.

Such, briefly, is an outline of a process which gives fair promise of utility to the gas manufacturing engineer by at once removing and recovering the ammonia in a marketable form and reducing the sulphuretted hydrogen content to a considerable degree. The sulphate of ammonia salt thus obtained appears to be formed of rather larger crystals than in the direct processes, and had, in the sample shown to me, a tint peculiarly its own. It was, however, a good salt, giving upon analysis 99·44 per cent. sulphate of ammonia, with 25·63 per cent. ammonia.

This modified process has now been in continuous use at the Königsberg Gas-Works for about twelve months, and has dealt with the entire gas production during this period. Herr Kobbert has kindly furnished me with the following particulars for your information: The process has extracted practically all the ammonia from the gas treated; and the salt produced contains from 96 to 98 per cent. of sulphate of ammonia, with an ammonia content of 25·4 per cent. This, you will notice, is confirmatory of that produced in coke-oven working. As with this process the ammonia is extracted at temperatures ranging between 68° and 104° Fahr., its utility in town gas-works practice will be readily appreciated.

To further utilize sulphur dioxide vapours to complete the extraction of sulphuretted hydrogen, is but a natural sequence to the foregoing; and experimental work is being carried out, and practical data obtained, by several investigators in this direction.

Reduction of Sulphur Compounds.

The necessity for the reduction of sulphur compounds has re-asserted itself in some instances, and, as in the case of Cheltenham, a modification of the coal-liming process has been successfully applied to this end, with the avoidance of lime purification, and its accompanying nuisance. You are already familiar with the details of this system as furnished to the industry by Mr. Paterson.

But there are not wanting other investigators, both in America and our own country, who are proceeding on somewhat different lines—mainly, I believe, in the direction of reducing the sulphur compounds to sulphuretted hydrogen, which, of course, is comparatively easily dealt with. If these latter efforts meet with the success they deserve under extended working tests now proceeding, simple oxide purification may yet prove the only finishing process required in obtaining a practically sulphur-free gas; and this, worked on the "backward cycle" system, brings us almost as near to purification in closed vessels as it is possible to come with solid purifying materials. In my own case, "backward cycle" working entails only the emptying and the recharging of a nest of four purifiers once in two years—*i.e.*, an average of one purifier per half year.

The recovery of cyanides, though in itself full of interest, and remunerative to those at present engaged in it, is not a direction in which any general movement is advisable unless a better market is forthcoming; and even then the economical limit of minimum production will operate in many cases against its adoption.

Truly, in what may be classed as the purification pro-

cesses, there is great activity and natural development—such as to provide the engineer with plenty of scope for useful employment in designing, devising, and selecting.

STORAGE AND THE ILKESTON DISASTER.

There are, of course, many other matters in the design, selection, and construction of gas-works and plant in respect of which the sounder the engineering ability that is brought to bear, the more valuable will be the service eventually rendered to the consumers. But we must pass them by with a simple nod of recognition.

One can, however, scarcely treat that economizing factor, storage, with such scant courtesy. Here, again, changing conditions and requirements have their effect; and local circumstances—such as variability of draught as between night and day, and as between the different seasons—have a determining influence upon the proportion that storage bears to output. But this is a comparatively light matter to decide, as against the type and character of the structure and its containing vessel. Nor would there have been much occasion to make mention of this subject, had it not been for the unfortunate Ilkeston disaster.

Guide-Framing and the Spiral System.

The choice of guiding systems in this country having resolved itself into that between steel framing of various styles and the spiral system, and the greater proportion of recent structures being of the latter type, the question may pardonably have been regarded by many as "settled." In fact, in many instances it had undoubtedly become a mere matter of cost. Deplorable as was the Ilkeston disaster from many points of view, it was to the engineer in no respect more so than in the scantiness of the evidence directly bearing upon the prime cause. This appears to be still wrapt in mystery; and, as a consequence, much room is left for speculation. I think it will be generally agreed that it would be a misfortune to the industry if this most ingenious and rigid of gasholder structures should stand condemned in the minds of gas engineers on insufficient grounds. In the judgment of many well able to form an opinion, it has yet to be demonstrated that this system is in any way inferior to the vertically guided method, provided the curb or rim of the containing tank is of sufficient rigidity; and those holding this opinion have been more than confirmed in their views by contributions on the subject from the pen of Professor F. K. Th. van Iterson, of Delft, which are worthy of the closest study. Here is an instance where discriminating powers of the first order are required by the engineer about to decide upon the type of holder to instal.

The Tank.

The questions involved in the containing tank are of a somewhat different nature; and here, if anywhere, to err on the side of excessive strength is a safe policy. It must not be forgotten, when comparing the merits of steel as against brick, masonry, or concrete tanks, that conditions of subsoil, water movements, &c., have ofttimes been the cause of distortion and general enlargement of the structure, even when wholly or partially sunk in the earth; and such movements are inimical to the guiding system, whatever its character.

Holders and Pressure.

Increased pressures in general distribution have had their effect upon the disposition of material in holder construction—so much so that, whereas a few years ago the engineer's object was to lighten the holder as much as he possibly could, now we find him considering means to increase the total weight, with a view of providing a higher range of pressure; and one may be pardoned for pointing out that the increased weight, added where most required—*i.e.*, in the inner lift—cannot be too widely disposed. Indeed, the lower in the lift the better will it be for general stability, by avoiding top-heaviness. And here we find ourselves merging the questions of distribution or supply with those of manufacture. The two are, of course, interdependent, and react each upon the other. Keeping down the pressures in the distributing mains has become an obsolete axiom, simply and solely on account of altered conditions and requirements; and one is fairly safe in saying that pressures generally are more than double those in vogue (say) twenty years ago during lighting hours, and more than treble those previously customary during other parts of the day.

Distribution or Supply.

From one who has, up to the present, had no personal experience in high-pressure distribution, you will not expect any lengthy reference to this means of supply. Here, again, local conditions and requirements must rule; and he is lacking in discretion who adopts any method or apparatus merely on account of its novelty, or that he may be considered up-to-date. Have we not known of instances in which the millstone of injudicious selection of plant or apparatus of vital moment has proved such a dead-weight around the neck of an undertaking that it has taken many years to cast off its pernicious influences?

The distribution or supply section of our operations may be said to have come into its own of late, and is certainly receiving much nearer the amount of attention its importance demands. It is one thing to provide a constant supply of any commodity required by the public, and quite another to advise the purchaser acceptably as to the best and most efficient methods of adapting it to his particular use and purpose. Our industry has been a long time appreciating the fundamental difference between producing pure and simple, and marketing its wares; but now that the engineer and commercial man have joined forces, and have taken into their counsels scientific ability of the highest order, he would be a bold man indeed who attempted to prognosticate the extent of the beneficial results that will accrue to both the community and the industry.

Utility of Higher Pressures.

Though having no occasion at the moment to supply my own particular area at a higher pressure than is obtainable from the holders themselves, one is nevertheless alive to the greatly extended utility—particularly in many industrial districts—of a gas supply under much higher pressures than formerly. One thing becomes self-evident in this regard—viz., the consumer generally is much more inclined to take a high-pressure supply when it is already provided at his doors, than when he is under the necessity of finding space and power and investing capital in what he considers to be the gas suppliers' business. I have found the cost of compressing plant in itself a prohibitive bar to the adoption of high-pressure lighting, as doubtless have many others. The enormous range of adaptability opened out by high-pressure supplies is such that I think we scarcely realize its full import at present; and due acknowledgment should be made to those undertakings that are doing valuable pioneer work in this connection.

The question of long-distance supplies has also assumed a new importance under high-pressure conditions; and as an auxiliary and feeder for outlying low-pressure distribution systems, it has in numerous instances proved extremely serviceable. Yet we must not overlook the fact that many of the objects and purposes to which our gas supply is applied are fully realized and served under comparatively low-pressure systems—even to some forms of lighting, when the total covering cost is taken into account.

The Need for Elastic Systems.

This is possibly the most unexplored ground of all, though in process of being rapidly exploited. There is no cure-all in the question of modern gas supply—no rule, method, or standard which will meet all requirements. It is the understanding and appreciating of the consumers' needs first and foremost that must form the basis of future gas supply methods. And here we find ourselves in a literal maze of diversity of aim, object, requirement, or condition; and none but the most elastic systems can successfully grapple with the multitudinous problems presented. We are coming to realize that low pressures in the general supply do not provide sufficient range of action; and whereas it is but a matter of mechanical adjustment to reduce from a higher to a lower potential, the conditions surrounding the contrary process are ofttimes prohibitive. Once the initial pressure of gas delivery is placed constantly above that required for all working purposes, the first step towards an infinitely wider field of application is taken.

The Distributing Engineer.

From this point forward, we find the requirements changing with bewildering variety, and evolving much greater demands upon the ingenuity of the distributing engineer. And here, again, the altered requirements are evolving a distinct class of gas engineer, who has certainly not the least interesting or important sphere of operations in which to disport himself. Primarily a purveyor of potential heat energy in one of its cleanest and most concentrated forms, his is the important function of applying it to all kinds of purposes, domestic and public, industrial and commercial;

and we may take it now that, for all practical purposes, his operations are mainly based upon the principles of the bunsen burner—but employed in such a diversity of ways as never surely entered the head of the man whose name the system of gas aëration prior to combustion bears. In the practice of metallurgy alone, the application of gas heating calls for play over the whole gamut of attainable temperatures, and furnishes most practical instances of the vital differences between volume and intensity of heat production.

Surface Combustion.

To attempt to enumerate the manifold purposes to which, under these infinitely wider conditions, public gas supplies are being, and will in the near future be, put, would become wearisome. Their name is legion; for they are many.

Yet there is promise of considerable additions when the applications of surface combustion, so closely associated with the name of our first Livesey Professor, Bone, become more general. To those who have interested themselves in the work of Professor Bone and his coadjutors, as disclosed in his various lectures, the direct utility of this invention to the gas industry may appear somewhat problematical; for its practical application (as revealed by themselves up to the present) would appear to be aimed more at the utilization of coke-oven and cheaper forms of gas than of town gas. It may possibly be that they discern a more remunerative field than that offered through the gas industry itself; but, in any case, a little patience is necessary to enable so great a departure from accustomed practice to find its bearings and adjust itself to its environments—or, shall we say, for the environments to adjust themselves to the newcomer? However, any improved process of gas utilization is bound to reflect beneficially upon our industry in the long run; and our duty, on all grounds, is to offer the latest arrival all the assistance that lies in our power.

Assistance of Manufacturers and Scientists.

At this point, it would be ungracious did we not offer our meed of praise to our colleagues the designers and manufacturers of the great variety of apparatus now being called for to develop the latent heat energy of our gas supplies in every direction for purposes of lighting, heating, and power. Theirs has ever been to a large extent the pioneers' part in these matters. Hence is readily explained the response they gave to the Institution's lead in research work at the Leeds University, and the impetus which flowed therefrom to all branches of investigation.

Great, too, is our indebtedness to the valuable collaboration of those of higher scientific attainments than ourselves; but greater still does it promise to be in the immediate future. Investigation work of the character of that done by Professor Bone, Dr. Harold Colman, Dr. Rudolf Lessing, Mr. A. Forshaw, Mr. Harold Hartley, Mr. E. W. Smith, and many others, and likewise the sympathetic guidance of men of the calibre of Professor Smithells, Professor Dixon, and Professor Lewes, cannot fail to prove of the utmost service to the community, as well as to the industry.

Relationship of Consumer and Supplier.

Of late years it has been borne in upon us that, to enable us to take our true place in the economy of the world, and more particularly of our own nation, we must throw off that apathy and false modesty which has long led the public we serve to depreciate the many and valuable services rendered by our industry. The consumer had been so long left to his own resources, to seek advice wherever his inclinations led him, and himself to decide upon the disposal and application of our commodity once he had purchased it, and withal encouraged in this course by the attitude of the industry itself towards him, that any change in the methods of dealing with him was at first resented, and not unnaturally. But the growing adoption of systems more in keeping with current commercial practice is effecting a radical alteration in the relationship between consumer and supplier; and, as is the case with suppliers of other commodities of which he is the user or consumer, he now looks for—in fact, demands—advice and guidance, to enable him to make the best possible use of that we furnish to him.

The Commercial Official.

Hence has come to pass the collaboration of the commercial official, whose chief qualification is to possess a thorough grounding in all that the distributing engineer can provide him with, a ready grasp of the consumers' requirements, and, above all, the faculty of anticipation and suggestion; for his has become a most responsible post—the actual connecting-link between all parties. Indeed, upon him, to a very large extent, the credit of the supplying undertaking depends. In many cases, the manufacturing engineer and manager, the distributing engineer, and the commercial official are perforce rolled into one; and his joint office is no sinecure, if he would worthily discharge all the duties devolving upon him. But whether or not the magnitude of the operations demands this combination, the fact remains that the engineer must have much more than a "bowing acquaintance" with commercial matters, and the commercial official must have more than a smattering of knowledge of distribution engineering. Thus the industry evolves her own officials for her own peculiar requirements.

GAS REQUIRED.

One of the chief problems with which the gas engineer is faced to-day—and the same problem will be for all time continually at his side—is to determine the product most suitable to the requirements and conditions of his *clientele* generally. This cannot always be determined with the ease and accuracy that many of his working tests and analyses may. He must be ever on the alert to note discrepancies, to observe the trend of changing requirements, and to anticipate developments.

Time was, when working under fairly stereotyped conditions, his main product and its method of supply were determined for him, and his course lay within very narrow well-defined limits. Such, however, is far from being the case to-day; and upon the manufacturing and distributing gas engineer devolves the onus of instigating and initiating in every department, but in none more so than in that of supply and public service. Moreover, upon the requirements of his public depend his methods of manufacture, always with a view to the most economical general effect; and it is this economical final result of his service that he must ever have in mind.

The Most Suitable Gas.

What are the requirements with regard to our main product as we see them to-day? In the year 1900, Mr. W. H. Y. Webber delivered a lecture before the old Gas Institute entitled "The New Gas," the gist of which was the advocacy of following the lead of our German friends in what one may call the simplification of the gas product. Being unhampered—at any rate, to a much greater extent than we are in this country—undoubtedly enabled our German *confrères* to respond more readily to the changing requirements and conditions of the time, aided, no doubt, by their natural gas product being of somewhat lighter composition than our own.

A striking diagram was shown, illustrating that, while gradually reducing the more complex constituents of a German gas of nominally 12·77 English candles until they were practically eliminated, the illuminating power consistently fell until a minimum of 2-candle power was reached. The accompanying fall in calorific value was from 600 to 553·7 B.Th.U. But the illuminating power in an incandescent burner with a fixed consumption of gas of 3·673 cubic feet per hour rose from 64 to 73·668 candle power. The percentage increase and decreases are most instructive even now, and run out as shown by the following table:—

	Per Cent.
Decrease in illuminating power of gas	84·34
,, ,, calorific value ,,	7·71
Increase in illuminating power of incandescent gas light	15·10

Increase in Yield and Sales.

Our home experience has again and again amplified these results, until it would almost appear to be useless reiteration to once more state them, but for the fact that such fundamental truths cannot be too forcibly emphasized. Since the date referred to, events have been steadily progressing—resulting in an increased yield to the consumer of a more suitable and adaptable gas per unit of raw material used. A reference to the Board of Trade returns relating to the authorized gas undertakings of the country shows that over the twelve years since passed, the outputs and yields have increased as shown by the table on p. 702.

From this it is to be gathered that, while the output has increased by 36·54 per cent., the sales have increased by 43·55 per cent.; and while the yields per ton of coal have increased by 5·82 per cent. in coal gas alone, and 13·87 per cent. on the total gas output, the total sales have increased by 19·79 per cent., or nearly 20 per cent., per ton of coal used.

—	1898 Returns.	1910 Returns.	Increase.	Increase per Cent.
Coal carbonized	12,841,817 tons	15,397,783 tons	2,555,966 tons	12·12
Total gas made	145,551,189,000 cubic feet	198,733,354,000 cubic feet	53,182,165,000 cubic feet	36 54
Coal gas made	138,146,995,000 ,, ,,	175,277,192,000 ,, ,,	37,130,197,000 ,, ,,	26·89
Total gas sold	127,365,077,000 ,, ,,	182,833,928,000 ,, ,,	55,468,851,000 ,, ,,	43·55
Total gas made per ton of coal	11,334 ,, ,,	12,906 ,, ,,	1572 ,, ,,	13·87
Coal gas made per ton of coal	10,757 ,, ,,	11,383 ,, ,,	626 ,, ,,	5·82
Total gas sold per ton of coal	9912 ,, ,,	11,874 ,, ,,	1962 ,, ,,	19·79

This is indicative of a much improved actual yield to the consumer, and shows improvements in both manufacture and supply, yet is nevertheless far short of that which is attainable—more particularly if the hampering restrictions which beset the industry can be removed or modified. The No. 2 "Metropolitan" burner is in a fair way to assisting in the removal of many anomalies in this connection; and the cessation from uneconomical striving to maintain impracticable standards will in due course tend to much greater yields per unit of raw material, to the final benefit of the consumer.

A Calorific Standard.

That there is a steady movement towards a calorific, as distinct from an illuminating, power standard, is self-evident. But we should do well as an industry, in the interests of all concerned, to see that the stage of transition is reduced to a minimum, for the working to both illuminating and calorific standards is irksome as well as uneconomical. To be penalized under a dual standard for deficiency in either or both should be deprecated from every point of view.

The example now set in the Wandsworth Amalgamation Bill, whereby a calorific standard is set up in lieu of, rather than in conjunction with, the illuminating power standard, is to be commended from all standpoints, and is a welcome precedent, well calculated to operate in the direction of economy of production and efficiency of service.

The question of expressing the calorific value of a gas in "gross" or "net" terms, is certainly ripe for decision, now that Parliament is adopting calorific standards. And one fails to see any special reason against the adoption of the "gross" as a standard, which should surely be as inclusive as possible. If to this, too, be added the value in British thermal units, instead of calories, the coming standard of gas values will be considerably simplified.

A Personal Experience.

A reference to one's own experience on these points may be considered *apropos*. In our endeavours to meet the changing conditions and requirements, the following tabulated statement will be more intelligible and to the point than any fulsome explanation:—

Comparative Statement showing Yearly Makes of Gas per Ton of Coal, with Illuminating Power and Calorific Value.

Year.	Make per Ton. Cubic Feet.	Illuminating Power.* Candles.	Calorific Value. Net. B.Th.U.
Average of five years ending Dec. 31, 1902	10,200	17 to 17·5	Not taken.
Year ending Dec. 31, 1903	11,308	16·70	516
,, ,, 1904	12,009	15·90	511
,, ,, 1905	12,028	15·92	519
,, ,, 1906	12,048	15·62	558
,, ,, 1907	12,099	15·22	542
,, ,, 1908	12,261	15·24	526
,, ,, 1909	12,411	15·88	522
,, ,, 1910	12,007	15·50	514
,, ,, 1911	12,045	15·37	522
Average of nine years	12,024	15·70	525

* Tested at the standard rate with the No. 1 "London" argand, and the Methven screen generally.

After what is practically a nine years' experience on the total output with 15-candle and 500 B.Th.U. net or 550 gross standards, working the two together as nearly as possible to keep above them, it would appear that a 550 B.Th.U. gross standard is fully ample for all requirements, and the illuminating power of little moment. Indeed, were it not for our parliamentary standard being 15 candles, we should pay very little attention to it.

As during the foregoing periods various experimental methods have been in use, the general results are not attributable to any one system. But whatever modifications may have been employed at any one time, the same object has been constantly kept in view—namely, the 15-candle and 550 B.Th.U. gross working standards.

The Nitrogen Content.

Like many others, one is constantly running up against the nitrogen content in experimental work upon increased makes; and for two months during the early part of last winter this diluent was purposely increased by small increments, until 20 per cent. nitrogen was reached, with a view to ascertaining what effect (if any) its inclusion had upon the calorific value of the gas. It is interesting to note that, in every case up to 20 per cent. nitrogen, the actual calorific test somewhat exceeded the theoretical value, when working to the 15-candle and 550 B.Th.U. gross joint standard. This is also our general experience. What effect so high a nitrogen content might have upon flame temperature and the various uses to which town gas is now applied, is another and evidently much wider question, and one that requires most thorough treatment.

Naphthalene Deposits.

One other limiting factor is constantly with us—namely, the naphthalene content. Although this may not apply in every case, experience with us has determined the condition which will prevent the deposition of this crystal in undesirable places—namely, maintaining the proportion of benzene and heavy hydrocarbons at 4 per cent. of the total volume. Should they fall much below this proportion for any length of time, naphthalene deposits inevitably make their appearance; and upon restoring the equilibrium of hydrocarbon vapours, they gradually disappear. This is effected by the simple addition (cold) of a petroleum distillate of ·81 sp. gr. in comparatively small quantities.

Simplification of Gaseous Contents.

But whatever be the methods of production, simplification of gaseous contents is a *desideratum* from an economical standpoint, on account of the smaller volume of air required for combustion, and greater rapidity with which the simpler gases are reduced to complete combustion products. M. André Grebel, in dealing with the supersession of the illuminating power test of coal gas by a calorific power test, points out that, in regard to developing light from the incandescent gas-mantle, a "matter of importance is the quantity of heat produced per hour under the mantle;" and he goes on to say that "in a given mantle, one can pass more of the mixture of air and gas, or more calories, *only if the combustion is more active*. . . . Thus with water gas of 2600 calories (about 289 B.Th.U. gross), but requiring only 2½ volumes of air for its complete combustion, temperatures of about 1800° C. (about 3272° Fahr.) may be obtained just as readily as with coal gas of 5100 calories (about 567 B.Th.U. gross) requiring 6 volumes of air." And in his table of the co-efficients of combustion of different gases, he gives the calorific power of 1 cubic metre of a theoretical self-combustible mixture of coal gas and air as 657 calories, as compared with that of the same volume of plain water gas and air of 686 calories.

Table *showing the Calorific Value of 1 Cubic Foot of Air when Burnt to Complete Combustion with the Principal Constituents of Coal Gas.*

—	Volumes of Air Required for Each Volume of Gas or Vapour.	Gross B.Th.U. per Cubic Foot of Gas or Vapour.	Cubic Foot of Air per 100 B.Th.U. Gross.	Gross B.Th.U. per 1 Cubic Foot of Air.	Average of Calorific Duty per 1 Cubic Foot of Air as Used with Simpler or More Complex Constituents of Coal Gas.
Hydrogen	2·38	326·2	·730	137	= 136·5 B.Th.U. with simple gases
Carbon monoxide	2·38	323·5	·736	136	
Methane	9·52	1009·0	·943	106	= 107·6 B.Th.U. with complex gases and vapours
Heavy hydrocarbons as ethylene	14·28	1588·0	·899	111	
Benzene	35·70	3807·4	·937	106	

Let us, however, take it in another way, by approaching the question from the standpoint of the calorific duty obtained per unit of air required by the different constituents of coal gas for their complete combustion.

From the foregoing table, it will be seen that the simple and non-luminous constituents give to the air required for their combustion a calorific duty 26·8 per cent. higher than do the more complex constituents; or, viewed yet another way, the volume of air required for the complete combustion of the simpler gases is from one-fourth to one-fifteenth of that for the heavier compounds. Both the calorific duty per unit of air consumed and the volume of air required for the combustion of a given unit of gas are surely factors which must operate towards meeting the gas requirements of the immediate future, and are indications of the direction in which gas manufacture must develop.

SUNDAY REST FOR GAS WORKERS.

The true engineer will also devote considerable attention to that most essential of all natural forces he is called upon to manipulate—namely, Human Labour; and of all the forces at his command, this is, perhaps, at once the most potent and the most sensitive. While deprecating anything approaching "coddling," it may, I think, be safely stated that labour does not always receive the consideration that it deserves—not so much in the matter of remuneration as in the direction of keeping it fit and maintained at a high state of efficiency. This human machine undoubtedly requires a certain amount of rest and recuperative opportunity; and no time is more suited to this very necessary condition than the British Sabbath. Yet it is still a fact that a considerable proportion of the most arduous part of the labour employed on gas-works—that is, stoking—is continued during the Sabbath all the year round.

An Investigation.

Some ten years ago, it may be remembered, I was permitted to lay before you the results of certain inquiries on the question of "Sunday Rest for Gas Workers;" and at the instigation of those interested in Sabbath observance, I have been induced, after the lapse of this period, to again make inquiries as to the progress of the movement. The results of these inquiries I now place before you; and for the benefit of those sufficiently interested in the matter, they are tabulated on similar lines to those previously published, in order to render comparison easy.

Briefly stated, the total number of replies to some 1600 circulars issued is as follows:—

—	Replies Received. 1902.	Replies Received. 1912.
Undertakings represented	438	471
Proportion to whole number	27·37 per cent.	29 per cent.
Works practising Sunday stops	218	183
Proportion of those replying	49·77 per cent.	38·85 per cent.
Proportion of total number in the United Kingdom	13·62 ,,	11·25 ,,
Works not stopping	220	288
Proportion of those replying	50·23 per cent.	61·15 per cent.
Proportion of total number in the United Kingdom	13·75 ,,	17·70 ,,
Total gas make of the United Kingdom	159,000 million c. f.	205,087 million c. f.
Gas make of undertakings replying	106,000 ,,	138,113 ,,
Proportion of total make in the United Kingdom	67·04 per cent.	67·34 per cent.
Make of works practising Sunday stops	83,310 million c. f.	97,212 million c. f.
Proportion of make of undertakings replying	78·59 per cent.	70·38 per cent.
Proportion of total make of the United Kingdom	52·39 ,,	47·40 ,,
Make of works that do not practise Sunday stops	22,690 million c. f.	40,901 million c. f.
Proportion of make of undertakings replying	21·41 per cent.	29·62 per cent.
Proportion of total make of the United Kingdom	14·14 ,,	19·94 ,,

From the foregoing analysis, it will be noted that, from the returns made (and it must be borne in mind that these are quite voluntary, and do not contain some undertakings which made returns before—more particularly among the works practising Sunday stops), just under one-half of the carbonizing employees in the industry enjoy a greater or less amount of cessation from labour on the Sabbath.

The replies are briefly set out and classified in condensed form, according to output, in the accompanying statements "A" to "I." As it would occupy too much space to place them in juxtaposition with those tabulated in 1902, I must refer those who desire to make a comparison to the "Transactions" of the Gas Institute for that year. From these two sets of statements, the following particulars may, however, be culled, and compared:—

Length of Time During which Stops have been in Vogue.	Number of Undertakings which have practised Sunday Stops over that Period.	
	1902 Returns.	1912 Returns.
80 years	..	1
60 ,,	1	..
47 ,,	..	1
40 ,,	1	2
37 ,,	..	1
35 ,,	1	2
30 ,,	2	6
28 ,,	..	1
26 ,,	1	..
25 ,,	..	4
22 ,,	..	2
21 ,,	..	2
20 ,,	6	1
19 ,,	..	2
18 ,,	..	1
17 ,,	..	2
16 ,,	1	1
15 ,,	1	8
14 ,,	1	..
12 ,,	1	4
11 ,,	1	1
10 ,,	1	16
9 ,,	..	4
8 ,,	..	7
7 ,,	..	2
6 ,,	..	6
5 ,,	1	7
4 ,,	..	5
3 ,,	1	13
2 ,,	..	6
1 ,,	..	6
"Many years," and indefinite periods.	10	10

From this it will be gathered that quite a substantial number of works have adopted Sunday stops within the last ten years; and as it is fair to assume that the bulk of those practising Sunday stops ten years ago continue to do so still, the movement may be considered to be developing to that extent (72). It needs no explanation to an assemblage of gas men to account for the fact that many works are of such a character, or are so situated, as to prohibit Sunday stoppage of gas-making operations at every season of the year, be the management never so willing; and the following comparison shows the various seasons over which Sunday stops are practised:—

Seasons of Stopping Other than the Year Round.

—	1902 Returns.	1912 Returns.
Summer months	22	12
Nine months	4	2
Eight ,,	5	6
Seven ,,	..	1
Four ,,	..	1
Thirty Sundays per year	1	1
Fortnightly	4	5
Every third Sunday	..	1
Four-fifths of Sundays	..	2
Three-fourths ,,	..	1
Two-thirds of year	..	1
One-half of Sundays	..	1
One-third ,,	..	1
When stock permits	3	..
When possible	1	1
Frequently	..	1
Occasionally	..	1

Further, the duration of stop has an interest peculiarly its own, and dependent upon a variety of factors. The following table (p. 704) gives a comparison of the two sets of returns under this head.

In each case it will be noted that the 12-hour stop predominates; and, taken all round, with retorts in various stages of wear, it is perhaps the economical limit. In my own case, the rule is to stop for 12 hours fortnightly—this being the change shift with 12-hour normal shifts, and ensuring each stoker 24 hours' rest. Stops are also effected on intermediate Sundays, when circumstances are favourable, and occasionally are extended to 24 hours. It may be permissible to note, in passing, that at Grantham our conditions of supply and demand at Christmas time are such as generally to permit of entire stoppage for 24 hours, or thereabouts. To be precise, gas-making operations have ceased during Christmas over the last thirteen years without a break for from 24 to 18 hours; the average being 23·3 hours per stop. Of course, it might so happen that in some cases this season would be the worst possible for the purpose.

Duration of Stops.	Number of Undertakings.	
	1902 Returns.	1912 Returns.
24 hours	7	8
24 to 18 hours	1	..
24 to 16 ,,	..	1
24 to 12 ,,	6	10
24 to 10 ,,	..	1
24 to 8 ,,	3	1
24 hours to *nil*	..	1
20 hours	..	1
20 to 16 hours	..	1
18 hours	1	3
18 to 12 hours	2	1
18 to 6 ,,	..	1
16 hours	8	11
16 to 12 hours	1	1
16 to 8 ,,	10	4
15 to 12 ,,	..	1
14 hours	..	1
12 ,,	113	88
12 to 9 hours	1	2
12 to 8 ,,	5	1
12 to 6 ,,	12	3
12 to 4 ,,	3	..
10 hours	2	1
10 to 6 hours	1	1
9 hours	8	2
9 to 6 hours	..	2
8 hours	18	12
8 to 4 hours	..	1
6 hours	9	6
6 to 4 hours	1	..
4 hours	1	..
Not given	5	17

As in the case of the previous returns, the negative replies are the most interesting; and the number of those who consider Sunday stops impracticable for one reason or another, but are in favour of stopping as a general principle, is shown by the following comparisons:

—	1902 Returns.	1912 Returns.
"Nay" undertakings which minimize Sunday labour	45	81
"Nay" undertakings in favour of Sunday stops	181	209
"Nay" undertakings not in favour of Sunday stops	11	14
"Nay" undertakings neutral	4	8
"Nay" undertakings indifferent, or do not say	24	24

As was to be expected, the bulk of the reasons given for not entertaining the idea of Sunday stops in their individual cases are generally similar in character to those in the previous instance. But, though not stated in so many words, there are evidences that improved carbonizing and ancillary plant are in themselves effecting a considerable diminution in Sunday labour in many cases where the practice is to work through—as instance the large increase in the proportion of works minimizing Sunday labour. This in itself undoubtedly militates against the actual cessation of gas manufacture, while ensuring a large proportion of rest to the workmen.

The following are some of the reasons given for not suspending carbonizing on Sundays.

Some Reasons for Not Suspending Carbonizing on Sundays.

—	Number of Undertakings.	
	1902 Returns.	1912 Returns.
Insufficient storage	60	60
Deficient carbonizing plant	3	1
Smallness of plant	..	11
Defective or unsuitable plant generally	35	13
Deficient storage and carbonizing plant combined	6	..
Improvements in plant	..	2
Closer attention required	..	4
Difficulty with heats	..	3
Cannot avoid Sunday stoking	..	2
Afraid of cost	..	5
Growth of demands	..	1
Stokers relieved by labourers	..	20
Local conditions	5	12
Tried, but unsuccessful	..	3
Impossible to arrange	..	4
Extra pay for Sunday work	12	14
Extra responsibility	..	1
See no reason for it	..	1
Not anxious to stop	..	1
Heavy Saturday night demands	..	3
Heavy Sunday demands	..	2
Objection of workmen	2	10
Injury to retorts	..	1
Injury to plant	..	4
Loss entailed in stopping	6	1
Men want paying for stops	2	..
Because of eight-hour shifts	5	..
Workmen relieved other days	3	..
Not seriously considered it	..	1
Reverted after two years' stops	1	..
Carburetted water-gas plant	3	4
Consider undertaking would suffer	..	1
Increased capital, maintenance, and labour charges	..	1

It will be noted that, of the 471 undertakings replying, 14, as against 11, in 1902, pointedly object to Sunday stops; their reasons (where any are stated) being included among the foregoing.

Our Moral Obligations.

As these reasons were dealt with rather fully in 1902, and those of to-day bear much the same impress as then, little

Class A.—*Works Making up to 5 Million Cubic Feet per Annum.*

Works Practising "Sunday Stops."

No.	Duration of Stops, in Hours.	Remarks.
1	12	..
2	12	..
3	12 for nine months of year	During last three years through improved plant
4	Not stated	Improved plant enables to stop
5	Occasional in summer months	..
6	12	Last seven years through improvements in plant
7	12 occasionally	Improved plant and storage rendered this possible
8	12 year round	Last eight years
9	18	Improved plant assisted
10	12 frequently	Regenerative firing assists
11	12	Increased storage greatly assists
12	10 to 24	Improved plant enabled to stop over last four years
13	12	During last three years
14	18	During last four years
15	6	Heating difficulties prevent longer stops
16	9	Over last eight years, but consider loss too great
17	12 eight months of year	Plant will not permit of winter stops
18	6 to 18	Improvements in plant enabled to arrange Sunday stops

Places "Working Through."

No.	Reasons for not Stopping.	In favour of Sunday Stops.	Remarks.
1	Holder too small	Yes	..
2	Smallness of plant	,,	Afraid of cost
3	Deficient storage	,,	Relieves stoker on Sunday
4	Smallness of plant	,,	..
5	Insufficient storage	,,	..
6	,, ,,	,,	..
7	Improvements in plant increased Sunday labour	,,	..
8	Too much trouble	,,	..
9	Deficient storage	,,	..
10	Smallness of plant	Indifferent	..
11	Closer attention required than formerly	Yes	..
12	Not stated	,,	..
13	Deficient storage	,,	..
14	Smallness of plant prevents total stop	,,	Improvements in plant enabled to considerably minimize work
15	Difficulty with heats	Do not say	..
16	None given	Indifferent	..
17	Deficient storage	Yes	..
18	,, ,,	,,	..
19	Consider plant too small	,,	..
20	,, ,, ,,	Do not say	..
21	Not stated	Yes	..
22	Plant not admit	,,	..
23	Not stated	,,	..
24	Minimize only	,,	Increased storage assisted to reduce labour
25	Consider smallness of plant prohibits	,,	..
26	Minimize	Do not say	..
27	Minimize as much as possible	Yes	..
28	Cannot avoid some Sunday stoking	,,	..
29	Minimize	Partly	Improved carbonizing plant assists

Class B.—*Works Making from 5 to 10 Million Cubic Feet per Annum.*

WORKS PRACTISING "SUNDAY STOPS."

No.	Duration of Stops, in Hours.	Remarks.
1	16 to 20	Last 6 years through increased storage
2	24 during 8 months	..
3	24	For last 7 years
4	24 in summer months	During last 9 years, after increasing carbonizing plant
5	9	During last 2 years, through increased storage
6	6, plant will not permit of longer stops	For last 3 years
7	12 save on exceptional occasions	For last 10 years, through increased storage
8	12 save on exceptional occasions	For last 10 years, through increased storage
9	12 save on exceptional occasions	For last 10 years, improvements in plant contributing
10	12 to 24	Improvements in plant facilitate stops
11	12 to 24	During last 3 years, improvements in plant facilitate stops
12	6	During last 4 years, improvements in plant assisting
13	12 save on very rare occasions	During last 4 years, due to improvements in plant
14	,, ,, ,, ,,	Last 10 years, due to improvements in plant
15	12	Plant remodelled
16	12	2 years, new works
17	24 during 8 months of year	During last 4 years
18	12 to 24	..
19	20	Last 5 years, improved carbonizing plant
20	6 to 9 save exceptional cases.	Last 3 years, improved plant
21	16	Last 11 years

PLACES "WORKING THROUGH."

No.	Reasons for Not Stopping.	In favour of Sunday Stops.	Remarks.
1	Do not state	Yes	..
2	Plant only admits of minimizing	,,	Contemplating the adoption of generators, when hope to stop
3	Not given	,,	..
4	Minimize greatly	,,	Additional storage caused reduction
5	Minimize only	Do not say	..
6	Afraid of cost	Yes	..
7	Storage deficient	,,	..
8	,, ,, but minimize	,,	..
9	,, ,, ,, ,,	,,	..
10	Impossible to abolish at present	,,	..
11	Minimize	,,	..
12	,, last 3 years	No, on account of cost	Improved storage cause of reduction
13	New carbonizing plant does not admit of shutting down	Yes	..
14	Insufficient storage prohibits	,,	..
15	Greatly minimize	Partially	Improvements in plant assisting
16	Minimize	Do not say	..
17	Growth of demands	Yes	..
18	Plant only allows to minimize	,,	..

Class C.—*Works Making from 10 to 20 Million Cubic Feet per Annum.*

WORKS PRACTISING "SUNDAY STOPS."

No.	Duration of Stops, in Hours.	Remarks.
1	12	Increased storage and regenerative firing enabled to stop over last eight years.
2	6 to 12	Last six years, increased storage assisting
3	12	Last three years, increased storage assisting
4	6	Last three years, improved plant assisting
5	12	Last three years, increased storage assisting
6	9 to 12	Improved plant assisting
7	12	One year since storage increased
8	8	Last eight years, improved plant assisting
9	12	Last seventeen years
10	12 to 24	One year. Increased storage facilitated stops
11	12	Last ten years, improved carbonizing plant assisting
12	14	Last nine years, ample storage assisting
13	12	Last two years
14	18	Last six years, improvements in plant assisting
15	12 to 24	Improved carbonizing plant facilitates stops
16	12, six months in year	Deficient storage prevents more
17	10, for four summer months	,, ,, ,, ,,
18	9 to 12	..
19	12 to 24	Last three years, increased storage assisting

PLACES "WORKING THROUGH."

No.	Reasons for not Stopping.	In Favour of Sunday Stops.	Remarks.
1	Minimize	Yes	..
2	,,	,,	Relieve stokers by labourers
3	Plant too small for demands	,,	..
4	Minimize considerably	,,	For last six years
5	Minimize	,,	..
6	Deficient storage	,,	..
7	,, ,,	,,	..
8	,, ,,	,,	..
9	,, ,,	,,	Stokers relieved by labourers
10	Minimize	Do not say	..
11	Not given	Yes	..
12	Minimize	Partially	..
13	Local conditions	Not stated	..
14	Minimize	Yes	Stokers relieved by labourers
15	Deficient storage	,,	..
16	Minimize considerably	,,	Nine years, storage favourable
17	Not given	,,	..
18	,,	,,	..
19	,,	Indifferent	..
20	,,	Yes	..
21	Deficient storage	,,	..
22	Minimize	,,	Stokers relieved by labourers
23	,,	Indifferent	Stokers relieved occasionally
24	Apparently deficient storage	Yes	..
25	Not in a position to stop	,,	..
26	Minimize, but impossible to stop	,,	..
27	Insufficient storage prohibits	,,	..
28	Insufficient storage, but minimize	Do not say	..

useful purpose would be served by reiteration. Suffice it to point out to those who are more or less fearful of damage to plant, increased cost of maintenance of the same, loss in gas yield, and monetary considerations generally, attending Sunday stops, that these are not lions in the path, but mere shadowy imaginings, as those who have persevered beyond the experimental stage can amply substantiate; and when it is borne in mind that most of the works noted for high gas makes regularly practice Sunday stops, further confirmation should be unnecessary.

To the enthusiastic Sabbatarian, I would also point out that improved methods of manufacture are gradually but surely reducing the total labour employed in gas-works on Sundays, and to a much greater extent than these summaries from the returns appear to indicate, and are moreover tending to make the every-day lot of the stoker more tolerable and less exacting than of yore. A good man with a shovel still takes a lot of beating; but he is gradually being found more congenial employment in controlling powers greater than his own, and so, by a variety of circumstances, is becoming a more responsible person whose well-being it is the engineer's duty to study quite as much as that of his machinery and plant. But amidst it all, let us not lose sight of our moral as well as our business obligations in this matter.

Before leaving this subject, allow me to tender my thanks to all those who responded to my inquiries, and thus enabled me to take a comparative survey of this question of the reduction of Sunday labour—not so exhaustive as one could have wished, but sufficient to enable us to judge to some extent of the state of affairs in this connection in our own industry.

LABOUR AND CO-PARTNERSHIP.

After the troublous times we have been, and still are, passing through, a gathering of engineers and managers in daily contact with an army of workers of the various types engaged in the gas industry would be insensible indeed to current events and influences, could they eliminate the question of the seething restlessness in the world of Labour, even for the short period for which we are assembled. On the

CLASS D.—*Works Making from 20 to 50 Million Cubic Feet per Annum.*

WORKS PRACTISING "SUNDAY STOPS."

No.	Duration of Stops in Hours.	Remarks.
1	16	Two years. Works and storage extension enabled to stop
2	12	Last ten years. Storage extension enabled to stop
3	6 to 12	Last five years. Have ample storage
4	12	Last three years
5	12	Commenced 1911, through increasing storage
6	6 to 12 two-thirds of year	Practice more than ten years
7	6, seven months of year	..
8	8 to 12	Past twelve years
9	12	Over twenty years
10	12	Fifteen years
11	12	Twenty-five years
12	12	..
13	8	Nearly twenty years
14	12	Last four years
15	Not given	Last five years
16	8, eight months in year	..
17	12 to 15, six months in year	Over fifteen years
18	12	Over fifteen years
19	12, save in exceptional cases.	Last twenty-five years
20	Not given	During last year
21	12	During eight years
22	12	..
23	12, during summer	Past two summers
24	6 to 9, according to requirements	Past ten years
25	Not stated	Fully half number of Sundays during twenty-eight years
26	12	Twenty Sundays in summer, two years
27	12, save in exceptional instances	Every second Sunday, past ten years
28	12	Last thirty-five years
29	8 and 4, alternate Sundays	Last seventeen years
30	12, during summer months	Last two years
31	12, eight months of year	..
32	12	For fifteen years
33	12	Last eighteen years
34	12	Every other Sunday
35	Stop all Sundays, except under pressure in winter	..
36	12, summer 6	..
37	12	Last eight years
38	12	Improvement in plant enabled to abolish Sunday labour in day-time
39	12	..

PLACES "WORKING THROUGH."

No.	Reasons for not Stopping.	In Favour of Sunday Stops.	Remarks.
1	Tried, but not successful	Yes	..
2	Minimize	,,	Plant improvements assist in reduction
3	,,	,,	Stokers relieved in summer
4	Considers staff too small to stop	,,	..
5	Minimize considerably	,,	Expect to increase storage shortly and will then stop
6	,, ,,	,, conditionally.	New works, 1906
7	Conditions prohibit	,,	Stokers relieved once a month
8	Not given	,,	..
9	,, ,,	,,	Stokers relieved when changing over
10	Minimizing as much as possible	,,	..
11	Not given	,,	..
12	Plant not suitable	,,	..
13	Deficient storage	,,	..
14	Minimize	,,	Stokers relieved
15	,,	,,	..
16	Impossible to arrange	,,	..
17	Not given	,,	Hope to reduce in future
18	Minimize considerably	,,	When plant will admit
19	Deficient storage	,,	..
20	Minimize as much as storage will allow	,,	..
21	Minimize as much as storage will allow	,,	..
22	Not stated	,,	..
23	Minimize	,,	..
24	,,	Do not say	..
25	,,	Yes	..
26	,,	,,	..
27	,,	,,	Stokers relieved alternately
28	Deficient storage and no experience of shutting-down	Not given	May give it a trial
29	Minimize	As far as possible	
30	Deficient storage	Do not say	..
31	,, ,,	Yes	..
32	Not stated	,,	..
33	,,	,,	..
34	Deficient storage	No	..
35	,, ,,	Yes	..
36	Minimize as much as can	,,	..
37	,, ,, ,,	,,	..
38	Not stated	,,	..
39	Minimized five years	,,	Reduce utmost possible
40	Minimize	,,	Deficient storage prevents more
41	,,	,,	Last three years
42	Minimize considerably	,,	..
43	,, ,,	,,	Plant prohibits more
44	Conditions not favourable	,,	..
45	Deficient storage	,,	..
46	,, ,,	,,	..
47	Considers uneconomical	No	..
48	Works conditions will not admit	Yes, if possible	..
49	Men unwilling to miss time-and-half pay	,,	..
50	Deficient storage	,,	..
51	Minimize	,,	within limits, but considers stops involve management in greater responsibility. ..
52	Minimize 50 per cent.	,,	Over fifteen years
53	Carbonizing plant deficient	,,	..
54	Not stated	Neutral	..
55	Deficient storage	Yes	..
56	Not stated	,,	..
57	Fear loss	No	Stokers relieved Sundays
58	Not clear	Yes	..
59	Insufficient storage	,,	..
60	Minimize considerably	,,	Improved carbonizing plant a factor
61	Not stated	,,	..
62	Minimize	,,	..
63	Once tried stops, but considers experiment unsatisfactory	,, if practicable	..
64	Deficient storage	,,	..
65	,, ,,	,,	Increasing storage, and now hope to be able to stop
66	Modern plant requires more attention, and stops entail more work on management	,, if works large enough	..
67	Men object	,,	..
68	Men rather work	,,	..
69	Minimize, and stokers relieved	,,	..
70	Inefficient plant	,,	..
71	Not stated	,,	..
72	Tried, but experiment unsuccessful	,,	..
73	Deficient storage	,,	..
74	Minimize 50 per cent.	,,	..
75	Sees no reason for it	Indifferent	..
76	Men like Sunday work because of extra pay	No	..
77	Sunday charges reduced by half	Yes	..
78	Minimize	,,	Not anxious to stop
79	,,	,,	..
80	Deficient storage	,,	..
81	Impossible	,, where possible	..
82	Minimize	,,	..
83	,,	,,	Stokers relieved in turn

CLASS E.—*Works Making from 50 to 100 Million Cubic Feet per Annum.*

WORKS PRACTISING "SUNDAY STOPS."

No.	Duration of Stops, in Hours.	Remarks.
1	12	Last thirty years
2	8 to 12	..
3	12	Last twenty years
4	6	Last five years
5	Stop during summer months	Last three years
6	12 to 18	..
7	12, during five summer months	..
8	12	Last nine years
9	12	Last fifteen years
10	12	..
11	16 to 24	Since new holder recently erected
12	24	Past twenty-one years
13	12	Past forty years
14	12, every alternate Sunday	Past 1½ years
15	12	Past twenty years
16	12 to 24	Past nine years
17	12 to 24	Past five years
18	12, during summer months	Past six years
19	24	For long period

PLACES "WORKING THROUGH."

No.	Reasons for not Stopping.	In Favour of Sunday Stops.	Remarks.
1	Deficient storage	Yes	..
2	Heavy Saturday night demand	Yes	..
3	Not stated	Yes	..
4	Deficient storage, but minimize	Yes	..
5	Serious financial loss	Neutral	..
6	Deficient storage	Yes	Increasing storage, and then expect to stop
7	Not stated	Yes	Stokers relieved monthly
8	Minimize	Yes	..
9	Minimize	Yes	Stokers relieved occasionally
10	Not stated	Yes, where convenient	..
11	Storage deficient, but minimize	Yes	..
12	Minimize	Yes	..
13	Not stated	Yes	..
14	Minimize. Plant unsuited to stops	Yes	Expect new plant will enable to stop
15	Deficient storage, and heavy Saturday night de mands	Yes	Storage increased, and hope to effect stops in future
16	Stokers prefer to work	No	..
17	Not stated	Yes	..
18	Not stated	Yes	..
19	Minimize 10 per cent.	Yes	Stokers relieved once in fortnight
20	Deficient storage	Yes, where practicable	..
21	Not stated	Yes	..
22	Minimize as much as storage will allow	Yes	..
23	Not stated	Yes	..
24	Minimize	Yes	Stokers relieved
25	Minimize	Yes	..
26	Not stated	Yes	..
27	Not stated	Yes	Stokers relieved once in four weeks
28	Minimize	Not particularly	Stokers relieved once a month
29	Minimize	Yes	..
30	Not stated	Yes	..
31	Deficient storage	Yes	..
32	Men prefer extra pay	Yes	..
33	Size of plant does not allow	Yes	..
34	Saturdays and Sundays heavy days	Do not say	..
35	Minimize	Yes	..
36	Stokers do not desire it	Yes	..
37	Not stated	Yes	..
38	Not stated	Yes	..
39	Peculiar local conditions	Yes	..
40	Not stated	Yes, morally	..
41	Not stated	Yes	..
42	Deficient storage	Yes	..
43	Not stated	Yes	..
44	Inadequate storage	Yes	..
45	Minimize	Yes,if possible	..
46	Smallness of plant	..	Reducing Sunday labour
47	Not stated	Yes	.

contrary, the just position, remuneration, and interest of all employees throughout the industrial world—more particularly in our own country—is a matter requiring the closest attention of everyone occupying a responsible position in connection with any industry.

That adjustments are necessary from time to time in the relationships of the three main factors in industry—namely, Intellect, Capital, and Labour—must be accepted as historically proven. It is the inevitable corollary of Industrialism; and any material disturbance of the equilibrium between them has a deleterious effect upon all three, to say nothing of the great body of users or consumers who must eventually bear the total cost of production, whatever it may include. Possibly it is the fact that each individual producer is also a user or consumer of many commodities in addition to, or apart from, those he assists to produce, that holds a more or less automatic counterpoise, though in a rough and ready fashion. The worker feels, more than understands, that there are times when things are out of joint; and he proceeds to take measures to rectify that which appeals more immediately to him—mainly his pocket. It is for want of a more general outlook, or a less circumscribed area of survey, that he oft-times blunders, and irritates, instead of mollifies, the ailment.

A First Essential.

It would appear to be a first essential that, just as the individual worker must fully realize his relationship to himself in the different capacities of producer and consumer, so must he be brought to realize his relative positions as capital producer and capital user. Generally speaking, his financial horizon is bounded and confined by the question of revenue only; and it falls to the lot of others to account for, and conserve for his further use, the surplus productions which we denominate capital. Possibly he is not to be greatly blamed in this matter. Existing systems are evidently not the most conducive to the production of comparatively small capitalists in great numbers, though much more favourable than (say) fifty years ago. But if something of this kind can be effected, and the individual producer have some tangible proofs of the steady growth of his portion of surplus production, it must appeal to him beyond all the teachings of economic theories. And who can reasonably expect every worker to be sufficiently versed in economics to enable him to judge aright of that most vital question—his place and interest in the industrial machine? Identity of interest between the different industrial factors must be assured, if the prodigal waste of energy and the dissipation of accumulated wealth entailed by internecine industrial strife in the past, both distant and immediate, are to be avoided in the future. Destruction and depreciation may be correct objectives according to the rules of war, and when directed against a foreign foe; but they are nothing short of suicidal when applied to any one industrial factor by any one or more of the others, and any injury to a part of necessity affects detrimentally the welfare of the whole. At a time when the country generally is reaping and realizing the results of the recent industrial disturbance caused by the national coal strike, many minds are doubtless at work endeavouring to discover some practicable solution of the problem thus emphasized; and it is very unlikely that any one remedy, or set of remedies, will be found generally efficacious. As in all larger matters affecting the public weal, it would be unwise to force the pace unnaturally

Class F.—*Works Making from 100 to 250 Million Cubic Feet per Annum.*

WORKS PRACTISING "SUNDAY STOPS."

No.	Duration of Stops, in Hours.	Remarks.
1	12	Some years past
2	12 to 24, every second week	Twelve years or so
3	12	Fifteen years
4	8	One year
5	16, frequently	..
6	8	Last six years
7	Up to 24, in summer months	Last five years
8	About every third Sunday.	..
9	12	Nineteen years
10	12	Twenty-five years
11	Stop during nine months each year	Ten to fifteen years
12	12	Twenty-one years
13	12	Ten years
14	12	Last twenty years
15	12, save any exceptional cases	Over forty years
16	12, with few exceptions	..
17	12	For thirty years
18	12, save exceptional occasions	,,
19	6 to 10	For thirty-one years
20	12, eight months each year	Rapidly increasing consumption reduced from 12 hours year round
21	8	..
22	Stopped 80 per cent. of Sundays	One year
23	12 to 24	For many years
24	12	..
25	24, when possible	..

PLACES "WORKING THROUGH."

No.	Reasons for not Stopping.	In Favour of Sunday Stops.	Remarks.
1	As much gas wanted on Sunday as other days	No	..
2	Not stated	Yes	..
3	Injury to retorts, and men prefer to work for increased pay	No	..
4	Considers loss too great	,,	..
5	Not stated	Yes, if economical	..
6	,,	Yes	..
7	Men have one day off a week or fortnight	No	..
8	Not seriously considered it	Not particularly	..
9	Carburetted water-gas plant	Yes	..
10	Carburetted water-gas plant enables to minimize	,,	..
11	,, ,, ,,	,,	..
12	Character of plant prevents	,,	..
13	Not stated.	,,	..
14	Men prefer work at increased pay	,,	..
15	Deleterious effect on plant.	Yes, otherwise	..
16	Not stated	Yes, where economical	..
17	Deficient storage	,,	Recently increased storage. Giving matter consideration.
18	Not stated	,,	..
19	Deficient storage	,,	..
20	Men object to change	,,	..
21	Minimize	,,	..
22	Minimize, but men object to stops and reduced wages	No	..
23	Minimize by carburetted water gas	Yes, morally	..
24	Local conditions prevent	Yes	..
25	Consider company would suffer	No	..
26	Stokers object	,,	..
27	Not stated	Yes	..
28	Minimize 50 per cent.	,,	..
29	Heavy Saturday demands, and unsuitability of plant	Doubtful	..
30	Minimize considerably, due to machinery	Not particularly	..
31	Not stated	Yes	..
32	Minimize 50 per cent.	,,	For many years
33	Not stated	,,	..
34	,,	,,	..
35	Deficient storage.	,,	Storage being increased
36	Minimize over 30 per cent.	No	Fear damage to plant & loss
37	Minimize	Yes	,,
38	Men do not desire it	Neutral	..
39	Not stated	Yes	..
40	Men not favourable and feared expense	No	..
41	Men prefer to work for extra pay	Yes	..
42	Minimized last three years	,,	..
43	Heavy Sunday consumption	,,	..
44	Men prefer to work for extra pay	No	Fears extra work on management
45	Relies upon Sunday to replenish stock	,,	..
46	Not stated	Yes	..
47	Deficient storage, but minimize	Do not say	..
48	Tried, but men objected	Yes	..
49	Extra supervision and trouble.	No	..
50	Economic and other objections	Yes, otherwise	..

Class G.—*Works Making from 250 to 500 Million Cubic Feet per Annum.*

WORKS PRACTISING "SUNDAY STOPS."

No.	Duration of Stops, in Hours.	Remarks.
1	Various, about one-third of Sundays	Over twenty years
2	16, excepting when pressed	Last ten years
3	12	For long period
4	16, six summer months	Past thirty years
5	12	Over twenty years
6	12	Last thirty years
7	12, two-thirds of Sundays.	Last three years
8	12, except when pressed	Twelve years
9	12 to 16, as often as possible.	Ten years
10	12	Last thirty years
11	8 to 16.	..
12	16, seven months in year	Six years
13	12	About twenty-five years
14	Various, three-fourths of Sundays	Last five years
15	16, generally.	Last eight years
16	Not given. Half Sundays in year.	..
17	8	Last forty-seven years
18	8	Over fifteen years
19	12	Improvements in plant greatly assist
20	12	Many years

PLACES "WORKING THROUGH."

No.	Reasons for not Stopping.	In Favour of Sunday Stops.	Remarks.
1	Men do not approve, on account of extra Sunday pay	Yes	..
2	Men prefer work and extra pay	Not given	Improved carbonizing plant reduced number of men by one-third
3	Men prefer work and extra pay	Yes	..
4	Difficulty and danger	No	Improvements in plant made stopping more difficult
5	Local conditions	Yes, conditionally	..
6	Deficient storage and heavy week-end demands	Yes	..
7	Minimize as much as possible.	Do not say	Expect improved carbonizing to further minimize
8	Minimize 50 per cent.	Neutral	..
9	Character of plant will not permit	Do not say	..
10	Not stated.	Yes	..
11	Not in a position to stop	Yes	..
12	Discontinued stopping as men wanted extra Sunday pay	Yes, personally	Consider work smoother when working through
13	Not given	Do not say	..
14	Men relieved by eight-hour shift	Do not say	..
15	Deficient storage and irregularity of heats	Yes	..
16	Stokers only work six days per week, each man having one day off during week	Yes	..

CLASS H.—*Works Making from* 500 *to* 1000 *Million Cubic Feet per Annum.*

WORKS PRACTISING "SUNDAY STOPS."

No.	Duration of Stops, in Hours.	Remarks.
1	12	Improvements in plant greatly facilitate
2	Not given, but always stop save in emergency	..
3	16	Many years
4	8 to 16, except when consumption prohibits	Rule for considerable time
5	12, four-fifths of Sundays	A number of years
6	16, save when pressed	Sixteen years
7	8, most Sundays	Fifteen years
8	12	Improvement in plant

PLACES "WORKING THROUGH."

No.	Reasons for not Stopping.	In Favour of Sunday Stops.	Remarks.
1	Conditions do not admit	Do not say	..
2	Minimize 50 to 60 per cent.	No	Damage to plant and disturbances against stops
3	Men do not desire it	Yes, in the abstract	..
4	Minimize when holders full	Do not say	..
5	Minimize greatly	Yes, when practicable	Improvements in plan assist
6	Not stated	Yes	..
7	Not stated	,,	..
8	Minimize 20 per cent.	Yes, when practicable	Four years
9	Extra Sunday pay	Yes	..
10	Extra Sunday pay	,,	..
11	Increased capital, maintenance, and labour charges	No	..
12	Minimize considerably	Do not say	Last five years. Stokers relieved fortnightly

CLASS I.—*Works Making more than* 1000 *Million Cubic Feet per Annum.*

WORKS PRACTISING "SUNDAY STOPS."

No.	Duration of Stops, in Hours.	Remarks.
1	12	Twenty-two years
2	12	Many years
3	24	Ten years
4	8 to 24	Ten years
5	16	Over thirty-seven years
6	To full extent storage will permit	Considerable time
7	8 to 16	Twenty-two years
8	8, summer months	Minimize 20 per cent. in winter, during last ten years
9	8 to 16	..
10	8	Over eighty years
11	8	Last twenty years
12	12 to 16	Last ten years
13	Various, according to requirements	Considerable time
14	16, excepting under pressure	Fully twenty years

PLACES "WORKING THROUGH."

No.	Reasons for not Stopping.	In Favour of Sunday Stops.	Remarks.
1	Minimize	Do not say	Stoking machinery assists
2	Not stated	Yes	..
3	Deficient storage and congested plant	Yes	..
4	Not workable	Do not say	..
5	Not workable	Yes	..

towards the most promising schemes—more particularly any of a purely theoretical nature.

SIR GEORGE LIVESEY'S WORK.

Fortunately, we are not without practical illustrations of methods whereby the worker and capital interests may be more nearly assimilated than is now generally the case; and among the various ideas put to practical test from time to time, none as yet has given such promise or achieved greater success in a comparatively short space of time than that known to us by the name of Co-Partnership, the growing adoption of which in connection with our own industry is a striking tribute to the perspicacity and foresight of our late colleague and leader, Sir George Livesey.

Most of us remember his paper upon this subject read before the Institution in 1908, and the doubts expressed as to the probability of the scheme progressing when the master-hand should be withdrawn—doubts which the inexorable laws of Nature and the efflux of time have set at rest; for co-partnership has made much more substantial progress in the gas industry than appeared likely at the time Sir George wrote his paper, when the gas companies who had adopted it numbered five, whereas they now number thirty-five, or so, and show a disposition to progressive increase. Truly, he laid foundations more surely even than he himself wot of. Co-Partnership is an accomplished fact, not only in connection with our own industry, but in others of a variety sufficient to encourage the most pessimistic. As instance, societies founded by producers or consumers. Some sixteen textile businesses, twenty connected with agriculture, sixteen in the leather and boot trades, ten in the metal trades, eleven in building or wood-working, fourteen in the printing, &c., trades, and some two dozen or more in various other productive trades—from co-operative wholesale productive departments to umbrella makers. And added to these, must be mentioned some half-dozen firms originally of an ordinary commercial character, who have successfully adopted the co-partnership principle in one form or another over the last twenty-four years or so, in such industries as soap, cloth, boot and shoe, preserve, and confectionery manufacturers, and building trades.

Further, as will be readily understood, the capital employed in such a variety of industries, and the bonus bases, are of necessity likewise of a variegated order. In regard to capital employed, there will be found almost every conceivable combination, from that provided in the first instance by shareholders *per se*, and the gradual introduction of the co-partner as a proprietor, as in the gas industry, at one end, to the total provision of capital by the employees at the other; and bases of profit allocations, as distinct from interest on capital, varying from a percentage on salaries and wages to a division with capital of surpluses over and above capital's first increment.

THE GAS INDUSTRY AND CO-PARTNERSHIP.

But the gas industry takes first place in the extent to which it has adopted co-partnership in this country up to the present time; and herein lies its opportunity of giving a definite lead to the other industries, and thereby materially assisting in solving one of the most acute problems of modern times.

From the returns of the Labour Co-Partnership Association to the end of the year 1911 and of the Board of Trade, it is found that, of the total gas output of the authorized undertakings belonging to gas companies in the United Kingdom, 49·39 per cent. is produced by co-partnership concerns, or 54·66 per cent. of the total capital employed by those companies is linked to co-partnership working. If the proportion that co-partnership gas undertakings bear to the entire authorized gas undertakings of the United Kingdom (including those belonging to local authorities) be taken, it will be found that the gas production equals 31 per cent., and the capital employed equals 37 per cent. of the whole. Or, to state it in another way, the capital employed by co-partnership gas companies in the United Kingdom to date is more than that employed by all local authorities' gas undertakings; and the number of co-partnership employees working in conjunction with this capital is nearly 22,000. These are ample proofs that co-partnership has well emerged from the experimental stage, and, as applied to the gas industry, may be taken as a practical object-lesson by other industries.

A SUGGESTION TO LOCAL AUTHORITIES.

The circumstances of gas undertakings owned by local authorities being dissimilar constitutionally from those

belonging to companies, have acted detrimentally to the natural expansion of this beneficent scheme among them, excepting, perhaps, in the case of Stafford (I know of no other), where a satisfactory system of simple profit-sharing is in vogue. What local authority undertakings lack is a means whereby the bonus (the workers' capital nucleus) can be invested in the concern. True, as a ratepayer, he has some remote interest in the success of its operations; but it is so indirect as to be negligible in practice. Surely it is not beyond the wit of man to devise a special class of capital stock applicable to employees' accumulations only in the department concerned, and which might revert to ordinary corporation, &c., stock should a realizable amount be at any time greater than the then existing co-partners can take up. As a matter of principle, there is little, if any, difference between employees of a company's undertaking holding shares or stock alongside of the ordinary stock or share holders and those of a local authority's undertaking holding small units of corporation, &c., stock alongside of the individual investor—more particularly in face of the tendency of local authorities to raise money in smaller units than was once the custom.

At any rate, he who can devise a means of co-partnership application to the gas undertakings of local authorities will be a benefactor, alike to the industry, the employees, and the community, and will materially assist in minimizing the irresponsible disturbances which have been worked up of late in the stronghold of municipal gas supply. Whether or not this be achieved, the gas companies of the country have before them a fine opportunity of giving a practical example of cultivating a more equitable, and at the same time a more mutually acceptable relationship between the worker and his prime essential—capital.

There are so many phases of the application of the co-partnership principle, that if my address were confined entirely to this subject we should do little more than skirt the fringe of it; and as the system is entering so closely and so deeply into the vitals of our industry, I have prevailed upon Mr. Ernest W. Mundy, the Assistant-Secretary of the Labour Co-Partnership Association, to attend here to-day, and place his knowledge of the subject and personal advice at the disposal of any member who would care to discuss the matter with him.

THE PUBLIC.

No industry is better served by its Technical Press than is the gas industry; and it would be difficult indeed to suggest in what particular it could render better service than that now given. Ever ready to foster new developments or movements that have for their object the ultimate benefit of the industry, and to consolidate existing practice and institutions—at once chronicler, reviewer, critic, and general guide, philosopher, and friend—its services have proved to be of inestimable value. Still, for an industry that has faithfully served its public for a full century, the general newspaper Press takes little cognizance of those services; and when this scanty recognition is compared with the fulsome booming of younger and more precocious claimants for public acknowledgment, one may fairly inquire the reason. Reasons there undoubtedly are; but perhaps the principal cause lies with ourselves, inasmuch as our innate modesty has proved a great deterrent to publicity. This must no longer be, if we would be just alike to the public and to ourselves; and, as time advances, we shall doubtless acquire the art of presenting the many facets of our gem to the gaze of an appreciative public.

On an occasion such as the present, when assembled for instruction and intercourse, have we no message to the public? Is it not ready to take knowledge of our ways, and learn wherein we may be of further service? Methinks it is. And we certainly have a message; but it rests with ourselves to deliver it in an acceptable form.

Interesting Illustrations of the Uses of Gas.

Surely it is of some interest to the man in the street—aye, and to the man in the works and office, too—to know that the same familiar friend which lights his roads and home, upon which he mainly relies for the cooking of his daily food, is capable of rendering him many more services than those he is immediately acquainted with; that, in the most unostentatious manner possible, his gas supply is becoming more and more indispensable to him; that the gradual, though certain, leavening of his methods of warming his places of abode and business by gas-heating appliances is at the same time having a clarifying effect upon the atmosphere which envelops him, and is tending to purify the air he breathes, and this withal in an increasingly economical manner to himself.

Our public know in a general way that the gas supply of the country is a useful means of obtaining light, heat, and power, yet have possibly little idea of the ramifications of service covered by these simple terms. It may therefore be permissible to acquaint the aforesaid man in the street with the fact that, for instance, the clothes he wears and the money he mechanically jingles in his pockets have alike laid the public gas supply under contribution at some stage or another of their preparation; that the jewellery with which he adorns himself and members of his family, and the hat which crowns and completes his outfit, are indebted to a considerable extent to the same assistance in the course of their manufacture. He is propelled hither and thither, and served in a variety of ways, by machinery of every conceivable kind, yet he little recks the part that the homely gas supply is playing, to a rapidly increasing degree, in the forming more particularly of the finer component parts of this legion of machines.

Could the watch by which he swears to the correct time but speak, would it not inform him of the fiery ordeals through which many of its parts have passed prior to assuming their present form—many of them being at the hands of the demon Gas? Should he be of an artistic temperament, and have a penchant for art metal work, or metal enamel work, he will find on inquiry that it is the gas-furnace which has rendered many of the finer effects possible; that the best results are to be secured in such crafts as high-art earthenware, china, and glass staining only by the same medium. And so on, throughout the art and practice of metallurgy—more particularly among the finer metals—he would find the gas-furnace, in its various forms of smelter, muffle, oven, bath, blow-pipe, hearth, &c., becoming more and more indispensable as its utility is becoming more clearly demonstrated under modern conditions and applications.

In workshops generally, he would probably be astonished to learn the great variety of uses to which the ubiquitous gas supply is put—for warming, drying, boiling, tempering, and conditioning a variegated list of materials, where exactitude and controllability are *desiderata*. That gas tempering is the most important ally of high-speed steel tools, and that many important everyday workshop operations, scarcely noticeable on account of the ease and certainty with which they are performed, would be most irksome, and in many cases impracticable, without the assistance rendered by this ever-ready supply of heat energy. The gas-engine as a source of power he would probably tell us he is well acquainted with. He may possibly be aware that in many instances his favourite daily paper is printed by this form of power; but it would further interest him to know that the type itself is melted and cast in the linotype machine by means of the same heat medium. The vast possibilities of useful service at his disposal for a thousand-and-one purposes which tend to his eventual comfort and convenience, would, I think, provide innumerable object-lessons of the general utility of this branch of public supply, which would be, if anything, intensified did he know the magnificent part played by it, on his behalf, in matters of immediate personal comfort and relief through the chemist, the dentist, and his medical and surgical institutions. But the mere fact of being able to render him such manifold services is not our only claim on the attention of the man with the "modern eye." It may be of some interest to him to be told of these things; but it does not appeal to him greatly, unless he is made aware of the fact that they are rendered at a comparatively trifling cost, and one doubts if he has really grasped the truth that, along with the tale of increasing utility, marches that also of greatly increased efficiency and consequent economy.

Meeting Particular Requirements.

The methods of supply and charge have gradually undergone considerable modification to meet changing requirements; and it is of undoubted interest to our hosts of customers to know that, within reasonable limits, these methods are adaptable to their particular needs by means of differential prices, prepayment arrangements, &c., and that, though gas is still appraised at its value per 1000 cubic feet, there is, nevertheless, a distinct disposition on the part of the supplier to view it more from the point of its value for the purpose to which it is put, and the convenience of the

consumer in any particular. As instances of this disposition, we may point out the utility and popularity of the "slot" meter, which has established itself to such an extent that almost half the total number of gas consumers in the United Kingdom are now supplied by this means of charge and payment, and that, on a fairly low computation, they must at least form the means of exchange of over five million pounds annually, mostly in coppers, and its equivalent value in gas supplied.

Nor should we omit to indicate the growing use of that ingenious instrument the discount meter, and its later adaptation as a "Taxi" meter, whereby the sub-consumer (if one may coin a term) may provide himself with the necessary gas service on a purely cash basis, without the intervention of confusing terms and units with which he is not so familiar as with hard £ *s. d.* These and other methods of direct contract for light, heat, or power duties for private or public requirements should be indications to one and all that the "gas service" is a live service of great value and of equal flexibility.

The main thing the public have yet to fully appreciate is the fact that their needs and requirements are being closely studied and met. Once this becomes an accepted dogma by all parties, many obstacles and difficulties are removed. And herein lies the point—*it rests with the industry itself to propagate and accentuate this ability and readiness to serve.*

The Magnitude of the Industry.

Further, some little information as to the magnitude of the operations of an industry whereby he may compare it with others, has its uses in assisting the average individual in forming some idea of its relative importance. Thus, when he is informed that the capital employed in the gas industry amounts, in round figures, to 135 million pounds, he will compare it possibly with the National Debt or the capital employed in whatever industry he may himself be associated with. Or if we tell him that about 15½ million tons of coal are annually required to furnish the gas supply of the country—this being (say) some 25 per cent. more than that needed to run all the railways of the kingdom—it will convey to some minds a comparative idea of the extent to which it enters into the public, domestic, and industrial life of the country.

While to others it may appeal more forcibly to be informed of a concrete example of the ability of the gas supply to perform some particular function. To such it will prove interesting to know that the total gas sold in the United Kingdom contains sufficient heating power to raise some 315½ million tons of water from normal temperature to boiling-point yearly, or to provide more than twice the amount of boiling-water required for all domestic purposes throughout the United Kingdom. To say nothing of the bye-product coke, which provides double this amount of heat in addition.

To those whose mental comparisons run in the direction of power, it may be stated that the annual total gas sales of the United Kingdom, if converted into mechanical power, would develop over 9000 million brake horse power hours, or more than equivalent to the power required to run the entire British navy under normal average conditions.

Or, if others would prefer it to be expressed in terms of light—this being the original use to which gas was put—one may inform them that the total light obtainable from the gas now used in a year throughout the United Kingdom, with present-day forms of incandescent lighting, assuming for the moment that it be used for lighting, and taking an average computation, would equal over 3 billion candle-power hours, or over 400 million candle-power throughout the entire year, night and day.

Or, that this illuminating power, if applied entirely to street and road lighting, would provide a 1000-candle power light from sunset to sunrise the year round to each 100 yards of roadway, for a length of nearly 46,000 miles, or some 20 per cent. greater distance than that covered by the total gas-mains of the United Kingdom.

However, sufficient has, I think, been said to indicate the many sides which may be presented to his notice, and the interesting developments now taking place in our industry—enough to keep the British Commercial Gas Association fully employed in its self-imposed task of acquainting all and sundry of the great and increasing utility of this branch of public service, which has come to form so integral a part of present-day civiiization.

Progress and Restrictions.

It is a biological fact that the chief phenomenon of life is growth; and this test, as applied to the gas industry, assures us of a sound and healthy constitution. For after three-fourths of the century that has rolled over its head had expired, we find its growth in this country, for an industry of mature age, little less than phenomenal. During the period of threatened extinction, and restrictive legislation, the growth, as measured by capital employed, output of gas, or number of consumers, has, in the last quarter-of-a-century, been at the rates of 153 per cent., 135 per cent., or 206 per cent. respectively; and this, not on account of fostering legislative care, but despite the restrictive conditions imposed, and competition of a most strenuous character.

Greater Freedom Required.

It may have appeared necessary, in the earlier days of gas supply, to place and keep the industry in leading strings. But after the length of service now to its credit, and with competition of all kinds to face, it is not unreasonable to ask for a greater degree of freedom of action, to permit of that flexibility which is essential if changing conditions and industrial evolution are to be successfully met. There are some dozen local authorities' undertakings, and half-dozen companies, who are authorized to work without a prescribed illuminating power standard; and their general results adequately prove that this form of restriction might well be relaxed or entirely removed, and everyday conditions of supply left to determine the character of the gas required. Yet there is, in some quarters, an undoubted tendency to rather tighten the fetters than to ease them. Existing clauses affecting authority to undertake gas-fitting, &c., work, need carefully scanning and comparing with current model clauses before being abandoned—more particularly in the case of local authorities applying to Parliament for extension of powers—for the more liberty of action an undertaking has, especially in its relationship with its consumers, the better will be the general services rendered.

The Sulphur Clauses.

The sulphur question is one which extended experience has shown is quite capable of local solution, apart from any legislative restrictions; and the authority to adopt a more generally applicable standard burner, with the wholesale deletion of sulphur clauses, are together grudging admissions that irksome restrictions may safely be relaxed.

Alkali Manufacturers and Residual Products.

But while the relationships of Parliament and its Departments with the industry have shown signs of improvement in some particulars, they neutralize it to a great extent by reducing or narrowing the freedom hitherto enjoyed in other respects, and sometimes upon representations by interests external to the actual industry itself. Possibly the most glaring instance of this kind is the action of the Alkali Manufacturers' Association, whose revealed aim and object are the complete crippling of existing powers to work-up and make the best of residual products. Seldom has a movement inimical to the interests of the gas industry generally been so blandly initiated and so insidiously prosecuted. The plausible pretext that gas undertakings, having parliamentary authority for the manufacture and distribution of gas, must confine themselves to these two functions absolutely, lest they should be led to indulge in competitive business with some other form of manufacture—to wit, the Alkali Manufacturers, whose business it is to work-up residual products of gas-works into marketable commodities—has been used against us with the greatest success. Had the original project as revealed in their first onslaught been successful, gas undertakings would have found themselves faced with the most crippling conditions in regard to the disposal of all residual products, with serious consequences upon the price at which they could manufacture and supply their main commodity, gas.

But though the Alkali Manufacturers' Association have not succeeded to the extent of their original endeavour, they have, nevertheless, gained a sufficient foothold from which, if not dislodged, they are in a position to impose, and are actually imposing, restrictive clauses in Gas Bills as they come before Parliament, the cumulative effect of which (if successfully persisted in) will be the total prevention of intertrading in residual products between authorized and other gas undertakings, the abolition of the assistance now rendered in many instances by one undertaking to another,

or others, less favourably situated, and, what is possibly fraught with greater danger still, the handing over of the strong man bound, in the form of the bulk (in number) of gas undertakings, to alkali and other manufacturers, to receive of their bounty as to them, in their generosity, may seem fit. Competition effectually removed, and a parasitic monopoly permanently fastened upon the gas industry, would be the inevitable result.

I feel sure you must agree that I have by no means overdrawn the deduction; and, if this be so, then it behoves the industry to rise in all its might and arrest this pernicious movement before great damage is done. Some such sentiment as this moved your Council to take action, along with the Gas Companies' Protection Association; and we rightly look for whatever support may be necessary in combating to the utmost what they consider to be a very inequitable and crippling innovation.

Another insidious encroachment is the growing tendency of Parliamentary Committees to impose, at the instance of road authorities, increasing depths for gas-mains in public roadways. Barely had we accustomed ourselves to the imposition of a 2 ft. 6 in. maximum cover, than we find this (unnecessary depth under normal conditions) increased to 3 feet; and it is rather remarkable that the Wandsworth Bill, which heralds the emancipation of the industry from the thrall of the illuminating power standard, should be the measure to impose this most unwarrantable condition upon gas distribution methods. It cannot be too clearly emphasized that impositions such as this, which is much beyond any reasonably probable requirement, are detrimental to the public interest, inasmuch as they increase the cost of the service to the public, and are a useless tax on the industry.

Gas Profits and the Rates.

There is, however, one form of parliamentary restriction which must meet with general approval in such an assembly as this—namely, restricting the extent to which local authorities possessing gas undertakings may draw upon them for the relief of the rates. If a careful analysis were made of the reasons animating local authorities when seeking to acquire gas undertakings from owning companies, methinks the seductive rate-relieving argument would be found to predominate. But this is not conducive to the best interests of any community, when it is made *viâ* a department of public service. Whether a gas undertaking is administered by an owning company or local authority matters little as to the general principle which should dictate all administration—namely, the best and cheapest service possible in the local conditions ruling; and any attempt to fasten on an additional tax, either by way of disproportionately heavy dividend charges in the one case, or relieving other departments of public service in the other case, is to be deprecated to the utmost. In both cases the chief aims should be identical—namely, the lowest possible capital charges, with the cheapest possible service. What the gas industry needs most for free and full development is to be untrammelled by irksome and hampering restrictions, to be freed from all forms of inequitable taxation, and to be left at liberty to work out its own destiny in a natural and rational manner. Thus, and thus only, can she take her true place among the industries, and give that full and perfect public service of which she is capable.

ACTIVITIES OF THE YEAR.

While not wishing in any way to reiterate the contents of the Council's report, one may be permited a few remarks upon the activities of the year, more especially regarding the Institution and other organizations connected with the industry. In any such *résumé*, chief place will, I think, be accorded to the completion of the formation and launching of the British Commercial Gas Association—now well under way, and giving a good account of itself.

British Commercial Gas Association.

The successful inauguration of the British Commercial Gas Association is a striking example of the old adage that "Man proposes, and Providence disposes." Two years ago, many of our members were looking forward to an entire re-organization of this Institution, to meet the changing requirements of the times in which we live. Some, even, were inspired with the idea of its developing into a Central Organization thoroughly representative of all phases of the industry and its ramifications. But natural evolution would appear to have dominated the situation; and the Commercial movement of the District Associations, which first found expression at the initiative of Mr. S. Meunier and others in the Manchester District, about the year 1899, has culminated in the new organization as we have it to-day. That the British Commercial Gas Association was inaugurated and works under the auspices of this Institution, was but the final phase of a natural movement; and in giving it official countenance, and paternal assistance on its way, though at the same time apparently setting-back its own clock for some little while, the Institution has struck the true interpretation of its higher duties to the industry and the community at large. What developments the future may have in store for the Institution, is difficult to foresee; but time and patience are clarifying factors, and natural processes cannot be unduly forced, if healthy and vigorous growth is to be ensured.

Society of British Gas Industries.

One feature stands pre-eminent in the constitution of this the latest offspring of the Technical Societies of the industry—namely, the manner in which it has found common ground for useful action by every branch and section of the industry. And may I here point out the great assistance rendered in this connection by our colleagues of the Society of British Gas Industries? Founded only seven years ago, one well remembers the pessimistic opinions expressed at the time as to the incompatibility of the nominally diverse interests that it was sought to consolidate. The result has, however, fully justified the aims of the promoters; and it stands to-day a monument to faith in human nature, as well as a bright example of what can be achieved under most unpromising conditions—given but unanimity of aim and object. Fortunate indeed were we to find such a well-developed organization ready to our hand as an ally in the new commercial movement, and one which has rendered the Commercial Association as complete as human ingenuity can devise—an Association, by the way, whose watchword is, in effect, if not in so many words, "Each for the industry, and the industry for all."

Assisting the Gas-Fitter.

The somewhat extended efforts so courageously persisted in by Mr. Kendrick and others through the various District Associations and Institutions to improve the status and service of the gas-fitter—a matter which is of vital importance to the industry—deserve a word of recognition. The progress of this movement has proved burdensomely uphill work, and slow. Nevertheless, one may express the hope that it may be all the more permanent and thorough as a consequence. It is too late in the day to state, however concisely, the *pros* and *cons* of the subject. Let it suffice, therefore, to say the need for improvement was pressing, and was acknowledged on all hands; and that what was everybody's business ran great risk of becoming nobody's business. However, the various interests involved having been drawn into line, and a generally acceptable basis having at last been reached, it now rests with individual gas officials to see that the scheme is rightly applied, and beneficial results are certain to flow from it.

Institution Committee Work.

The various Standing Committees have been kept well employed during the year. In fact, one may say that the work of the Committees—or, at any rate, some of them—is a rapidly increasing quantity, and calls for some devolution of duties, unless a Professional President, who can devote the whole of his time to Institution work, is to be the result. Presidents, as yet, are persons of human limitations; and, despite daylight-saving proposals, there are still but twenty-four hours to the day.

Your Parliamentary Committee is becoming of greater importance as years go by, and has been particularly active during the past twelve months. It is, indeed, becoming the watch-dog of the Institution—one might almost say of the industry. The application of general legislation, and its effect upon our daily operations, provide a constant supply of interesting problems; while the action of Government Departments, and interests directly hostile or inimical to those of the whole industry, are ample safeguards against its falling into a state of atrophy.

The Recent Coal Strike.

To take a wider glance for a moment, a reference to the activities of the year would not be complete without some allusion to the unfortunate coal strike, and the troubles and difficulties entailed thereby. Some of us have had experi-

ences sufficient for a lifetime, and on emerging from them are faced with the necessity for revision of our basis for calculating the proportion that our stocks should bear to the year's requirements of raw material. The provision against curtailment of supplies through what one may term natural factors, are clearly insufficient; and who can estimate the extent of artificial inflictions in this direction that the future may have in store?

While guarding, on the one hand, against anything approaching panicky action, it is manifestly certain that considerable modifications must be accepted, and one more addition made to the many insurance premiums being imposed upon all classes of industry. The extent of the increased stock deemed sufficient against the evil day must still vary to some degree with locality; but proximity to the coal-fields must be discarded as a factor of any material advantage on this score. One feature stands out clearly—namely, the industry's reputation for continuity of supply must be most jealously guarded; and, as I must avoid dogmatism, I need scarcely commend the question to your closest individual attention.

Senior and Junior Associations.

In common with our own Council, the various District Associations and Institutions have displayed considerable activity during the year that is passed, and provided much technical fare of a high and useful order. The bonds which unite these different organizations to the premier body are proving increasingly serviceable—so much so that we may now be regarded as a concrete whole; and what is felt in any one portion of the kingdom is quickly communicated to the centre, and from thence throughout the whole.

Nor must we omit the Junior Associations, which have much more than justified their existence. Their productions, often of a first-class character, stamp at once the coming chiefs of the industry as men well trained and well equipped to take up the tasks which await them as the seniors from time to time hand in their seals of office and make way for youth, energy, and ability.

The sum-total of these various activities provides such a mass of material that our friends of the Technical Press are, I feel certain, ofttimes hard put to it to provide the necessary space to display the importance and utility of many of these contributions. On the whole, these are healthy signs, though at times somewhat of a tax upon the busy gas engineer, who would fain keep posted in all that is transpiring in his technical world.

Present and Future.

And what of it all? When we pause for a moment to take a review of our industry, its position in the world of industries, its utility as the provider of an important public service, the part it plays in modern civilization, have we reason for congratulation or the reverse? After a full century spent in the public service, may we still claim that the labourer is worthy of his hire? I think you will agree, and our public will agree, if it stay to give the question a moment's thought, that our industry has rendered true and acceptable service. And what of the future? On the eve of the Institution's Jubilee Year, what have we to celebrate besides an honourable and useful past? What will our 1913 Exhibition typify? Nothing less than perennial youth! Facing the future, with its exacting demands, its strenuous application, need one be a prophet to declare that the present is but the threshold to larger, wider, and even more acceptable spheres of action than have yet been occupied? Only those most closely and actively engaged in the industry have any conception of the potentialities therein contained. Then what is our present task, as true engineers, but in the widest sense so to design, so to build, and so to construct that the superstructure which others will base upon our present labours may prove one of enduring strength, of extreme utility, and of the greatest adaptability.

THE BULLETIN OF THE BRITISH COMMERCIAL GAS ASSOCIATION.

The second issue of the "Bulletin" of the British Commercial Gas Association shows it in the form that it is proposed that it shall take in future. The Editor (Mrs. M. A. Cloudesley Brereton) must be complimented both on the attractive style in which the issue is presented, and upon the subject-matter with which it is filled. The "Bulletin" will not only keep the subscribers informed as to the progress of the work, but it will contain from month to month information and ideas that will be valuable to gas undertakings and to gas salesmen throughout the country. The first article this month is on "The National Campaign;" and it is signed "F. W. G.," which initials expanded into proper terms give us the name of the active Chairman of the Executive Committee of the Association and of the Sub-Committees, and the Deputy-Chairman of the General Committee. His article, that of the Editor, and the notes of the Secretary (Mr. William M. Mason), taken together, show that the foundation for operations has been finished, and that operations are actively proceeding. To say the least, Mrs. Brereton has revealed an extraordinary grasp of the essentials in connection with the literary part of the functions of the organization; and the forecast that is made in her article as to the work that will be taken in hand indicates the vigorous manner in which the tasks of all concerned in the Association are being, and will continue to be, prosecuted. The directive committees and the executive officers have set themselves to not only justify the existence of the Association, but to prove that it is an essential creation under and in the modern conditions and environment of the gas industry.

A mere glance at the article by "F. W. G." is sufficient to assure us that the work that is being done collectively through the Association could not be accomplished by individual private enterprise. Take the advertisements that have been issued by the organization—advertisements illustrated in a manner that appeals to the modern eye, and which sends shafts of information through both picture and the accompanying laconic announcement. Private enterprise could not have produced and circulated them as they have been produced and circulated. Antiquated notions are all very well in some things, and they are respected in their place. But they have no place in the modern requirements of advertisement; and the Association, it is gratifying to see, are well protected through their officers—honorary and executive—against the drag of conservatism and the perpetuation of ancient form and idea in this particular. Every newspaper in which they have been advertising has a circulation and an influence of its own. In many of these papers private enterprise, generally speaking, would not dream of inserting gas advertisements. But do we not want the architect, the builder, the doctor, the nurse, the devotees of hygiene, the municipal councillor to know what can be, and is being, done with gas, and what fresh progress is being made. They have to be reached; they have their own special periodicals, and it is through the latter that the industry must come into contact with them. We want to get, too, to the leisured class; the prospective opulent customers of the industry for gas for heating purposes. They have their periodicals, through which we must get into touch with them. The gas industry has to go out of the common way in these matters; and initiative in this regard must be the very soul of the new organization. Through education, too, work is being done by Mrs. Brereton. Under her *nom de plume* "Nora M. Ramsay," a series of articles on the uses of gas is appearing in "Education"—the official educational organ of the County Councils' Association. Such work as this should kill the surviving notions that the old defects of crude gas utilization have still existence. Education in modern gas utilization is wanted. There are ways and means by which the British Commercial Gas Association can give it; and the work is well in hand. Those in charge of the affairs of the Association will be pleased to extend the list of subscribing undertakings published towards the end of the current issue of the "Bulletin." Those managements whose undertakings have not subscribed must feel that they are not doing their part in a work that must diffuse advantage throughout the industry.

Protection of concrete against freezing was accomplished in the case of a large reservoir at Virginia (Minn.) by covering the exposed portion with a layer of clay, then a layer of cinders, and above that a second layer of clay—making a total thickness of 18 inches. The reservoir, which was built for the Virginia Electric Power and Water Company, was 45 feet in diameter and 21 feet high, and was partly above and partly below the ground. When the covering was removed in the spring, the tank showed no sign of injury by frost, in spite of the severe winter; and the concrete appeared to be entirely water-tight.

A water-tight concrete tank, with walls 6 inches thick, was obtained by using a rich concrete mixture with good quality carefully-graded materials, in some recent construction work on the El Paso and South-Western Railway. The tank is 30 feet in diameter and 12 feet high. The concrete was mixed 1 : 2 : 4, or a little richer in cement; and the gravel was required to pass a ½-inch screen. No waterproofing was used. It is stated that the tank is entirely water-tight, except at joints between the courses of concrete. Another reservoir with a concrete lining 4 to 6 inches thick, built more than three years ago, and waterproofed with soap and alum, according to the Sylvester process, has proved water-tight during the entire period. The sand and gravel in this work are stated to be of fair grade only; the gravel reaching a maximum size of 1½ inches.

ELECTRICITY SUPPLY MEMORANDA.

At the Sign of the Queen's Head—Electrical Truth and Platitude—Expensive Electric Ovens Unattractive—Increased Fragility of Metallic Filaments with Use—The Bad Distributing Power of Metal Lamps—Improvement by Fixing Filaments in Form of Inverted Cone and by Suitable Reflectors—A Petty Paragraph—Reflected Illumination.

We have been to the electrical restaurant—the Queen's Head—at the Shakespearian Exhibition at Earl's Court; and there have indulged in a steak and other delicacies all said to have been electrically cooked. We had read that the cookers and appliances had been installed so that it was possible for all the cooking to be done by electricity in full view of the diners. But at the time of our visit most of the diners were having something or other from the grill; and the heavy smell of grilling, supplemented probably by the other cooking, that pervaded the large room (with the casement windows thrown fully open) caused the diners to shift themselves a respectful distance from the cooking apparatus, so that it was impossible for them to see what was really going on. We had gone there with printed declarations in mind that there would be no smell from these electric cooking appliances—more especially as it was known that, with admirable finesse, the designers of this cooking display had put up a 3½-horse power Sturtevant exhaust fan outside the building to draw off the fumes, and, in addition, a special 15-inch fan for dealing with the fumes from the fish and potato frier. Now fancy—after all we have been told time and again—the electricians themselves realize that the fumes from electrical cooking are of such dreadful quality and so refractory that a 3½-horse power Sturtevant fan is required to shift them! The "Electrical Review" is our authority for this. It writes: "For drawing off fumes from this part of the building, a 12-inch duct is provided, running along the top of the partition behind the range of cookers, in connection with a 3½-horse power Sturtevant exhaust fan outside the building. The fish and potato frier is provided with a special 15-inch fan for dealing with the usually obnoxious fumes arising from this process." While waiting for the steak, the waiter—not ourselves, but one of the restaurant servants—was asked whether he was glad the cooking was being done electrically. He shrugged his shoulders, and smiled—broadly. Then he cautiously said: "I am only a waiter, Sir. I am not the cook; and therefore I cannot say." The steak came up warm, not hot. The temperature of the steak suggested pre-cooking and a warming through when ordered. We cannot say whether or not this is so, as though the cooking is supposed to be going on in view of the visitors, it is impossible to see from the tables what is actually proceeding where the white-coated, aproned, and capped cooks are operating. No information is given regarding the cooking that is of any assistance to the visitor; all he or she knows is what he or she is told, that the food has been electrically cooked. The steak externally looked much like other cooked steaks, except that it had close to its periphery a burnt part that Sherlock Holmes would have suggested indicated that it had had very intimate acquaintance with the heating element. Cut through, the strata of the steak were clearly defined. The steak had an outside layer top and bottom well done, with an intervening layer well under-done. However, we were hungry, and that steak was enjoyed just as much as, but no more than, we should have enjoyed, with interior requirements in similar state, a steak cooked by any other means. There was no difference in the flavour of the steak from one cooked by other means, though electrical folks assert that, owing to some specially benign feeling towards electricity on the part of Dame Nature, heat electrically generated improves the flavour of the meat submitted to its gentle mercy.

Presiding at the annual meeting of the Urban Electric Supply Company, Limited, the Chairman candidly stated that anything like a general adoption of electricity for cooking purposes must necessarily be a matter of gradual growth, since there was naturally a great deal of prejudice and innate conservatism to be overcome. But those of their customers who had adopted the electrical process as their regular and normal method of cooking, and "quite a few" had done so, were, he believed, entirely satisfied with the results. "Quite a few!" Honest Mr. Chairman! More honest than Mr. Installation Topics, who in the "Electrical Times" says that "there is no class of cooking apparatus hitherto heated by gas which cannot as successfully and cheaply be operated electrically, and without the risk, fumes, and dirt inseparable from gas. Such platitudes are getting very old-fashioned in the electrical press. No explanation is given as to why a pennyworth of B.Th.U. gas-generated should not go much farther and do more in culinary operations—baking, boiling, and water heating—than a pennyworth of B.Th.U. electrically-generated. As for risks, with electricity there are the risks of shock, fusing, and stoppage of supply, as well as the ever-present risk of the cook losing her temper, and the employer the cook's services. As to cooking fumes, we had some the other day from electrical cooking with a 3½-horse power exhaust fan tugging away at them in the vain effort to keep them from our nostrils. As to dirt, now how can gaseous heating make more of this than electrical heating? Sensible "Installation Topics"!

Things are evidently not going well with the heavy-priced electrical cooking apparatus—that (and hitherto the cheapest) running from £10 to £15 to instal. The "Electrician," in effect, apologizes for the impertinence of electrical engineers in thinking that such apparatus would spring into immediate popularity, even supported by a mountain of fulsome, incorrect, and incomplete statement regarding electric cooking, and of scurrilous abuse of the gas process. Our contemporary confesses that it is "not only useless but foolish to expect the average man of moderate means to abandon his gas-stove for an elaborate electric cooking apparatus costing £10 to £15, as well as the attendant expensive installation." The price named and the attendant "expensive installation," therefore puts the "Tricity" set out of the field for the average man of modest means. To introduce the householder to the mysteries, merits, and demerits, expenses, and other drawbacks of electric cooking, the improved Simplex combination oven is now recommended, as this in liliputian size can be obtained at well under £2. We do not know the size of this oven, as "for correspondingly larger ovens" two 8-inch by 10-inch diameter plates, with, respectively loadings, of 1000 and 800 watts per hour, have been produced. But the smaller size is alleged to be capable of cooking chops and steaks, a bird (character not specified), or a small joint (say, of 3 lbs. weight). The largest pattern (size and price not stated in the information before us) is capable of taking a 9 lb. or 10 lb. joint.

Some interesting articles have recently been published dealing with metallic filament lamps. In one of the contributions, Dr. Brislee treats informatively with the changes that occur in metallic filaments during use; and in the other articles the poor light distribution of unaided metallic filament lamps is freely acknowledged by the respective authors. The subjects are of interest not only to electricians but to competitors, as they affect the question of merit in connection with competition. We have often read in the electrical press of wonderful life records of metallic filament lamps; we have also occasionally seen how the same type lamps are subject to brief life in service; we have also heard the denunciations of users when collapses have caused expenditure on the renewal of several lamps simultaneously or in close succession. It is now generally known that the filaments of these lamps are liable to be more readily broken when cold than when hot; and knowledge is becoming equally prevalent that after use the filaments are more fragile and more easily broken than when in the pristine state. Dr. Brislee confirms this in the cold, frank statement: "The metal filament of the modern incandescent electric light bulb becomes more fragile and more easily broken after use. In many cases"—that is to say, in not a few—"the vibration due to passing traffic, or the shaking due to cleaning the bulb, is sufficient to fracture the filament, and render the lamp useless." The early metallic filament lamp suffered from this defect more than the drawn-wire filaments. Dr. Brislee, however, must have had much trouble from the breaking of filaments, because it was the trouble he suffered this way that caused him to examine the filaments microscopically, with the view of determining, if possible, why an increasing deterioration in the strength of the filament occurs. The change in the filaments is found to be a very definite one; and the increase of brittleness after use suggests that the changes are aided by the high temperature at which the filaments work. Filaments from both new and used lamps were examined. The used filaments became completely crystalline; and some of the crystals grew to, comparatively speaking, large size. It is also suggested that it is probable that traces of gases are given off during the running of the lamps, and that this accelerates the changes.

So much for the advancing brittleness from which the metallic filament lamps suffer, and which is the cause of so much complaint of disaster and expense. There is next the inferior distribution power of this type of lamp, and of the necessity for properly shaped and fitted reflectors. This has become more apparent to the electricians since the inverted gas-lamp has shown them the large proportion of radiation it enjoys in the lower hemisphere, and the little waste that is incurred above the horizontal. The defect in the case of the metallic filament lamp is much the same as that of the vertical incandescent mantle. The metallic filaments are commonly arranged parallel to the vertical axis of the lamp, and in lamps of medium or high candle power in such a manner as to form a cylindrical cagework. The distribution of light is not of a suitable or efficient order; and therefore shades or reflectors have to be employed. M. Vodovosow has constructed lamps in which the filaments are arranged in the form of an inverted cone V. The filaments placed in this manner naturally require a special construction of lamp, the top of which forms a reflector. Compared with an ordinary wound lamp, it is calculated that the consumption per mean hemispherical candle power with the new lamp is 1·38 watts, as against 1·65 watts. The 20 per cent. superiority of the conical lamp on this basis is regarded as of great value. This is so regarded on the principle, with electric lighting, that every little helps.

Dr. Bloch is the author of the last article on metal lamps to which at present we will refer. He considers the question of the indifferent distributing power of metallic filament lamps in relation to the use of reflectors, which, of course, is a matter of great importance with the ordinary metallic filament lamp. A lamp, without reflector, that will give 100-candle power in a horizontal direction, will only supply 12-candle power in the vertical direction beneath the lamp, and quite 48 per cent. of the light is given in an upward direction. With these lamps, the use of reflectors is therefore absolutely imperative for street lighting. Importance, of course, attaches to the shape of the reflector. If a spherical one is employed (35 c.m. diameter), Dr. Bloch shows that the light immediately beneath the lamp is increased to 38-candle

power, but the upward rays are at best only partially utilized. The mean lower hemispherical candle power is now 94, as compared with 80 when no reflector is employed—an increase, therefore, of 17·5 per cent. A curve indicates that a clear glass globe also diminishes the light by 10 per cent. Using a parabolic reflector (50 c.m. diameter) with white enamelled surface, Dr. Bloch says the light in a vertical direction is 111-candle power; and the maximum illumination is 135-candle power in a direction inclined to the vertical of 43°, which he considers a very useful angle for street-lighting purposes, but which angle (from the vertical), in our opinion gives a too concentrated illumination. The mean lower hemispherical candle power is 122—*i.e.*, 52 per cent. more than when no reflector is used. Some advantage is moreover obtained by utilizing the upward rays, seeing that the light in a horizontal direction remains as before.

The following petty paragraph appears in the Commercial Supplement of the "Electrician": "The Hastings and St. Leonards Gas Company take their business far too seriously. In their showroom facing the Memorial, Hastings, they display an abundance of gas apparatus for lighting and cooking purposes. Naturally, they cannot give any advertisement to electricity; but they must keep cool, because the show-room is very close during the warm days. Rather than put in a couple of small electric bracket fans, they run a wonderful looking hot-air engine, which is direct-coupled to a fan about 24 inches diameter. Unlike all the other material displayed, this 'contraption' has no label offering it for hire or sale!" The particular gas-fan referred to is by Messrs. Harper, Phillips, and Co., of Grimsby. It is of the "C" type, 24 inches diameter. It has really been used as a working exhibit, although it has been found of considerable advantage in respect to the windows, which under some atmospheric conditions steam, and there is also occasionally sea mist to contend with. The fan has been quite successful, and is extremely economical. The contributor of the "Electrician" evidently looked into the window with one eye shut, because displayed prominently with all other notices is the following: "Gas-Fan for Drying or Ventilating Purposes." Moreover, our electrical friend is not very well up in his information; otherwise he would have known that the Gas Company would not hesitate to use electricity even for fans if required; for they have electrical power generated on the premises, and have electric fans in stock. The Company were among the first to show private users of electrical energy that a gas-engine driven generating set could produce electricity for lighting and power at a cheaper rate than the Electricity Department can afford to supply at for private purposes.

With a courtesy characteristic of its Commercial Supplement, the "Electrician" also puts to us a question in the following paragraph: "The 'Journal of Gas Lighting' is an illuminating publication (in more senses than one), and is frequently discursive on the future of gas as a domestic lighting agent. We should like to ask it what it thinks of the future of gas for indirect lighting in this sphere? No doubt our contemporary has observed the rapid extension of indirect illumination with both arc and metal lamps." For answer, see "JOURNAL" for March 19 last, pp. 792-5.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

Programme of the Annual Meeting.

As already announced in the "JOURNAL," the annual meeting of the Société Technique du Gaz en France will be opened in Paris on the 18th inst., under the presidency of M. Henri Marquisan. A brief indication of the nature of the proceedings has been given; but fuller particulars are furnished by a circular issued on Monday last week.

The morning of the first day will, as usual, be occupied with the admission of new members, the nomination of the members of the Committee, and the reception of the reports of the Committee and the Treasurer. In the afternoon, the business will consist chiefly of the distribution of the Government medals, and the presentation of reports on the prizes awarded for the best communications submitted at last year's meeting at Marseilles and to employees for long and meritorious service; the remainder of the time being utilized for dealing with some of the technical matters to be considered. On Wednesday, the 19th, the morning sitting will be devoted entirely to papers; and in the afternoon the members will visit the station of the Paris Gas Company at Le Landy. The banquet of the Society will be held in the evening at the Grand Hotel. Thursday morning will be given up to papers, and the afternoon to an excursion (which ladies are invited to join) in brakes to Versailles and to the aërodrome at Buc. On Friday morning, the remaining papers will be disposed of, and the meeting brought to a close.

There is a full list of papers and technical subjects. Reports will be presented by the Committees on Instruction, Coal Testing, and the Manufacture, Distribution, and Application of Gas; and there will be discussions on high-pressure lighting, the supply of gas at a distance, and the manufacture of gas from lignite and other materials. The following are the titles of the papers:

"Coal Supplies and the Lesson of the English Strikes" and "Mechanical Account-Keeping for Outdoor Works," by M. Masse.
"Mechanical Operation of Medium-Sized Works," by M. Crozet.
"Machine for Charging Retorts with Two Scoops Worked by One Man," by M. Besnard.
"Testing for Naphthalene in the Paris Gas-Works," by M. Laurain.
"Contamination of Gas in Holders," by M. Guillet.
"Use of Coke for the Production of Power in Gas-Works," by M. Lhomme.
"Comburimetry," "A Reflector-Economizer," and "A Ferro-Cerium Self-Lighting Tap," by M. Grebel.
"Continuous Testing of Gas by the Junkers Calorimeter," by M. Wateau.
"Prevention of Fraud through the Tilting of Wet Gas-Meters," by M. Billon.
"Centrifugal Appliances for High-Pressure Gas," by M. Foillard.
"Improved Apparatus for Preventing Escapes of Gas," by M. Picot.
"Gas-Oven of Constant or Variable Temperature," by M. Ch. André.
"Sewer Mud for Gas Making," by M. Fabre.
"Manufacture of Alimentary Ice," by M. Faucher.

It was originally intended to visit the works of the Liquid Air Company, at Poulogne-sur-Seine. But the project had to be abandoned; and the excursion to Versailles was substituted.

ASSOCIATION OF DUTCH GAS ENGINEERS.

Programme of Annual General Meeting.

THE current number of "Het Gas" contains the announcement that the fortieth annual general meeting of the Association of Gas Engineers of Holland will be held at Arnheim on the 8th, 9th, and 10th prox. There will be a reception of members by the Council of the town of Arnheim at the Town Hall on the evening of the 8th, followed by an assembly in the Concert Hall.

The meeting will be formally opened at 9 o'clock in the morning of July 9, under the Presidency of Heer O. S. Knottnerus, of Rotterdam; and the technical proceedings will continue, with an interval for lunch, until 3 o'clock. A visit will then be paid to the local gas-works, and the Gas Committee of the Corporation will entertain those present with light refreshments at the suburb of Velp. Members will dine together at the Concert Hall, and subsequently attend a concert. On July 10, the technical proceedings will be finished by mid-day; and in the afternoon there will be a steamboat excursion on the Rhine. The official dinner will take place in the evening.

The programme of business and technical proceedings includes: Opening of the meeting by the President; the reception of the reports of the Council and Treasurer; discussion of the reports of the Association's Committees on Photometry, Coal, Gas Oil, and the Archives and Library, and the re-appointment of these Committees; election of President and other officers for the ensuing year; and the reading of the following papers, which, with a number of questions of general interest, will be submitted for discussion. The papers are: "The Vertical Retorts at Arnheim, and the Working Results obtained with them," by Heer W. Meijer Cluwen, of Arnheim. "Descriptions (with demonstrations) of Different Types of Safety Meters, suitable for Hotels, &c.," by Heer J. Rutten, of The Hague. "The Manufacture of Sulphate of Ammonia in a Closed Saturator, with Removal of the Salt by Means of Steam," by Heer C. J. Snijders, Jnr., of The Hague. Twenty-one technical questions for discussion are set down on the programme.

Removing Incrustations from Water-Mains.—The formation of incrustations in water-mains is a frequent cause of trouble and expense to engineers, who sometimes find it more economical to replace an obstructed main than to scrape it. Some successful operations have lately been conducted at Batley and at Rhyl with the "Eric" pipe-scraper, which is constructed on different principles from those generally adopted. It consists of umbrella-shaped scrapers, which, under pressure, open out and cut away the incrustation; the tool being drawn away from the *débris*, which is flushed out, instead of being pushed forward. At Batley, 2600 yards of 15-inch main were, it is stated, cleared in 2½ hours of incrustation ¾ inch thick. The cost of clearing a main by this system is put at 1d. to 2d. per yard per inch diameter.

Large Gasholder for Baltimore.—The Bartlett-Hayward Company, of Baltimore, are engaged in constructing for the Consolidated Gas, Electric Light, and Power Company of the city a large gasholder, of which the following particulars have been published. The diameter of the bottom is 224 feet, and its weight 578,000 lbs. The outer ring is composed of 44 steel plates, 8 ft. by 13 ft., and 7-16ths inch thick; the intermediate ring, of 230 steel plates, 20 ft. by 7 ft. 6 in., and 5-16ths inch thick. The total height of the holder when completed will be 222 ft. 6 in.; and its capacity, 6 million cubic feet. The weight of the steel in the structure is 5,500,000 lbs.; the weight of water, 86,000,000 lbs. The holder has been designed to withstand a wind pressure of 100 miles an hour. The crown contains 35,000 square feet, and the weight of snow had to be considered in its design; for snow of average moisture, falling to a depth of 6 inches, would weigh about 5 lbs. to the square foot. Under such conditions, the weight of the snow would be 175,000 lbs.

STRIKE CLAUSES IN CONTRACTS.

Recommendation by the Parliamentary Committee of the Institution of Gas Engineers.

THE recent coal strike has brought this subject into prominence; and it has also revealed the existence of a large number of variously phrased clauses, some of them of such cryptic meaning that very wide interpretations can be placed upon them, and be defended. The Parliamentary Committee of the Council of the Institution of Gas Engineers are moving in the matter. In their recently issued report, it will be remembered, the following clause appeared.

> Arising out of the effects of the recent coal strike, the attention of the Parliamentary Committee has been called to the desirability of recommending a Model Strike Clause suitable for insertion in contracts made between gas undertakings and contractors for the purchase or sale of coal, coke, and tar, and other products, or with consumers for the supply of gas for both private and public lighting, and the matter is now under consideration.

Since then the Committee have come to the conclusion that, while there may be gas undertakings where strike clauses are unnecessary, the following (which is the Standard Strike Clause as agreed between the Lancashire Commercial Section and the Coalowners of the district) be recommended for general adoption with respect to the sale and purchase of coal and residuals:

> If by reason of any strike of workmen, general lock-out, or shortening of the daily time of labour, riot, a cessation of or material interruption of traffic on railways, rivers, or canals, or of any accident or other unavoidable cause, either party to this contract shall be unable to continue the supply, or to take delivery, as the case may be, of all the fuel which at the commencement of such disability he shall be under contract to supply, or accept the delivery of, then he shall not be bound during such disability to deliver or accept, as the case may be, any fuel which but for this clause he ought during such period to have delivered or accepted; and after the termination of such disability the gas authority* shall within one month after the cessation of such disability determine whether they require the quantity short-delivered owing to such disability to be cancelled or to be delivered. If in the latter case this contract shall be performed in the same manner as if the time for each delivery and acceptance to be made after the commencement of the said disability had been postponed, by a period equal to the duration of such disability, having regard to the proportional quantities, which, under the provisions of clause 18 hereof, are to be delivered during the period of the year when such deliveries are actually made.
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> CLAUSE 18 REFERRED TO IN THE FOREGOING.
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> Unless otherwise mutually agreed, the deliveries shall be at the rate of 40 per cent. of the total quantity during the months of March, April, May, June, July, and August, and 60 per cent. of the total quantity during the months of September, October, November, December, January, and February, and shall be in approximately equal quantities throughout each month as may be reasonably required by the gas engineer (or manager) who shall advise the Contractor at the commencement of each month of the quantities required.

With respect to the question of a clause dealing with public and private lighting, so many legal points are involved that the Committee are unable at the moment to make any definite recommendation.

AN AUTOCRATIC CLAIM.

In our "Correspondence" columns to-day, there is a letter from Mr. George P. Brown, of Ringwood, in which he calls attention to a claim on the part of the colliery owners who hold the contract for the supply of coal to the Ringwood Gas-Works, and which claim (we believe it is not the only similar one that has been made) we can only describe as autocratic, and a claim that not one of the colliery owners and agents with whose business methods we have acquaintance would dream of preferring, much less of enforcing. We have no knowledge as to who are the colliery owners concerned; but, at any rate, the circumstances do not appeal to us as being in any way equitable. According to Mr. Brown, the colliery proprietors in question did not make known to the Company the terms of the strike clause at the time the contract was entered into; and a direct application to them for a copy of the clause has received no response. The only statement in the contract is that the quotation is subject to a strike and accident clause; and, although the Company have no knowledge of the terms of the clause, the colliery proprietors now state with the utmost coolness, that their interpretation of it must be accepted. The claim is that the colliery proprietors shall deduct from the stipulated quantity of coal that they were bound to deliver (in respect of the six weeks during which the recent coal strike lasted) a proportion equal to six fifty-seconds of the quantity, and to charge an increased price of 2s. per ton for the amount they claim to deduct.

We cannot understand any colliery owners of high standing and business experience not informing their customers of the nature of the strike clause when entering into the contract, and more especially as it is manifestly not of customary form. At the same time, no Gas Company should enter into a contract without information as to the nature of the clause. But we do not believe that any Court of Law would uphold the colliery proprietors' claim, they not having disclosed to the Gas Company the terms of the clause prior to the contract being entered into, and those terms (although not unknown in the coal trade) being contrary to the general custom. If such a preposterous claim as this one could be upheld, it would simply mean that a firm of colliery proprietors or agents could, if they so desired, at any time substitute one strike clause for another more suitable to a particular set of circumstances, without one of the parties to the contract having any knowledge of the change. Under the circumstances, the suggestion of the colliery owners is outside the pale of both equity and commonsense. There is one thing clear, that clauses the terms of which are not disclosed are things to avoid in future; and coal proprietors who adopt the mode of doing business as represented by our correspondent ought to be rigorously placed in the same category.

The strike clause in question—the terms of which we can only gather from the interpretation put upon it by the colliery proprietors referred to—is not a recognized one within the knowledge of certain large colliery firms with whose methods of business in this respect (as already said) we have some acquaintance, and who in all their contracts explicitly state the conditions of the strike clause, and delivery is agreed to and governed by these conditions. Some gas undertakings insist on special forms of strike clause framed by themselves; and most large firms have contracts running containing clauses making different stipulations. But the clause most generally adopted and accepted by both parties is one providing that, during the time there is non-delivery owing to a strike, the contract is suspended; but at the termination of the strike, deliveries are to be resumed until the total contract quantity is delivered—the period of delivery being extended by the length of time to which the strike extended. There is another form of clause, which is occasionally preferred, providing that, owing to non-delivery through a strike, sellers should not be bound afterwards to deliver and buyers not be bound to receive, the quantity not supplied during the strike, but that the quantity may be cancelled. This leaves it open to either side to reject the quantity, or to mutually agree to deliver and receive the quantity. But such a clause is never imposed by firms of high standing without agreement on the part of the other side, and without the condition is clearly stated in the contract. A further form of clause (also occasionally preferred) prescribes a time-contract for weekly or monthly deliveries; and in this case the quantity is cancelled to the extent of the period covered by the strike. There are other contracts in existence in which it is merely stated that deliveries may be suspended during strikes. Possibly such a clause as this is the one the coal contractors to the Ringwood Gas Company had before them, though they did not divulge the terms to the second parties to the contract. Where such a clause as this obtains, there are firms—firms of high standing—who can say that they would feel it incumbent upon them (they being the sole contractors) to, after the strike, deliver the requirements of the undertaking up to the total quantity specified. They would regard it a matter of honour to do so, rather than a question of strict legal interpretation. But if it came to a matter of legal interpretation, we rather think they would consider it better not to raise any issue as to their rights over it if they had failed to disclose the terms of the clause at the time the contract was entered into. Under such circumstances, the more customary clause and conditions should be the ones to prevail; and these are that the full contract quantity shall be delivered at the contract price, with the time of delivery extended by the period of the duration of the strike. That is what ought in fairness now to occur in the case of Ringwood.

Mr. Brown's letter shows the necessity for this matter being revised. Several gas undertakings have been redrafting strike clauses for their new contracts, but it would be a good thing to get down to some fairly common basis in the matter. Therefore, the recommendation emanating from the Parliamentary Committee of the Institution of Gas Engineers, and referred to in the opening of this article, is one that should be carefully considered.

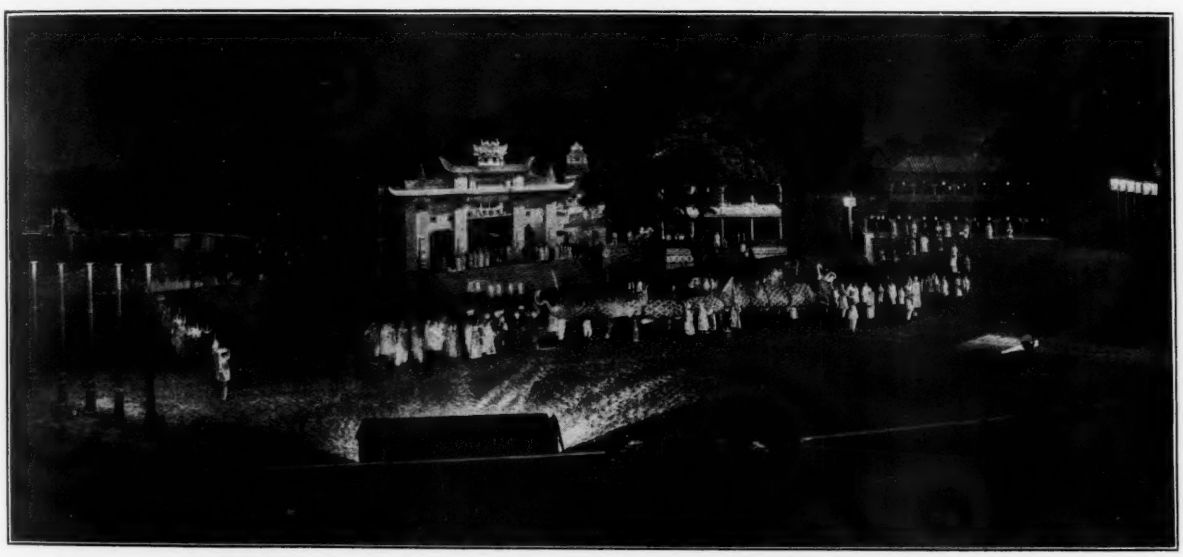
* In the case of the sale of residuals, the name of the purchaser would be substituted for the words "gas authority."

Water Softening and Purifying by "Permutit."—Reference has already been made in the "JOURNAL" to "Permutit"—a substance which has the property of removing certain constituents from water, and softening it. It formed the subject of a paper read by Dr. John F. Meyer at a meeting of the Institution of Municipal Engineers on the 22nd ult. The author explained that Dr. Gans, Professor at the Mining Academy of Berlin, made a thoroughly scientific investigation into the natural zeolites, classified them, and published the formulæ of their constitution. He subsequently succeeded in producing them artificially, and in 1906 took out a patent to manufacture them on a commercial scale. He named them "Permutit," from the Latin word "*permutare*," to exchange; the outstanding property of "Permutit," compared with the natural zeolites, being its greater power of exchanging its own base with other bases. Consequently, sodium "Permutit" can be readily converted into calcium, magnesium, ammonium, or potassium "Permutit," by passing through it solutions of these substances. One application of manganese "Permutit" is to sterilize waters containing harmful germs. It is stated that the initial and working costs of these plants is small; the latter being about $\frac{1}{6}$d. per 1000 gallons of water treated.

HIGH-PRESSURE LIGHTING IN AL FRESCO PAGEANTS AND PLAYS.

On the verdant-clad slopes of the Crystal Palace grounds, we are introduced to a new application of high-pressure gas-lighting. To the utilities of this form of lighting there appears to be no end. Its superlative attributes of high, steady, penetrating and well-diffused illumination, with the good quality of its light for bringing out colours in their natural tones, are causing it to be pressed into service in innumerable directions. But there is always a little hesitation in introducing into some fields untried means of accomplishing special purposes—such, for example, as the fields of public entertainment. High-pressure gas-lighting has, however, already been used with brilliant success and satisfaction in such places as skating-rinks and covered tennis courts. But the boldest schemers have never until this year introduced it into outdoor spectacular work such as the Chinese Pageant now running in connection with "China and Chinatown" at the Crystal Palace—a gorgeous spectacular effort invented and produced by Messrs. James Pain and Sons. In this immense and popular display (which no one who can possibly pay the Palace a visit should omit seeing) high-pressure gas-lighting plays the important part of being the general system of lighting. There is no doubt about it that high-pressure gas-lighting won the full esteem of the Crystal Palace authorities and of the General Manager (Mr. G. O. Starr) during the Festival of Empire Exhibition last year. Bold spirits conceived the idea of the application of the system of lighting in the Chinese Pageant this year, in the confident belief that the light would add to the brilliance and gaiety of the scenes, and would enable the spectators to feast on the bountiful grandeur presented in all quarters, in a manner that was impossible with the concentrated illumination afforded by the electric projectors and flame-arc lamps used in the pageant of last year. The conception was due to Mr. W. Wright, the Engineer to the Crystal Palace; and naturally he found hearty co-operation at the hands of Mr. S. Y. Shoubridge, the Engineer to the South Suburban Gas Company, and Mr. Horace Baldry, the Outdoor Superintendent of the Company. The absolute success of the venture is the reward of the enterprise, the appreciation of requirements, and the ingenious disposition of the lamps to secure the needed effects. The lighting, in fine, is so much part and parcel of the display that without it, precisely as it has been carried out, much of the charm of the spectacle would have been lost. We heartily congratulate Mr. Wright upon the success. The South Suburban Gas Company must take secondary place in praise for having faithfully executed his desires and plans.

Disposition and grouping of lights in such a scheme of spectacle as this are all-important. A more difficult "stage" to illuminate than this *al fresco* one could not be conceived. The extent of the area to be illuminated is something like 200 yards by 150 yards. Light must be thrown in some places with intensity, and in other places with modified effect, so that the whole expanse of the scene is brought with its different parts in due proportion within the range of the vision of the spectators sitting in the Grand Stand (which will accommodate some 7000 persons). The sky is the roof. There is no reflecting surface there for mundane artificial lights as in a theatre; the buildings afford but a scant proportion of reflecting surface; the grass-covered slope which runs downwards from the Grand Stand, the water in the lake nearly a couple of hundred yards from the stand, and the grey bridge and green-foliaged trees



The Chinese Pageant at the Crystal Palace under High-Pressure Gas Lighting (Chinese Dragon Scene).

[One group of lamps, with reflectors, is seen on the left; others to the extreme right.]

in the background beyond offer little or no assistance to the lights. But the whole scene to obtain the full beauty of the picture of animate beings and inanimate scenery, structural and natural, is brought within vision by the illumination. One has no difficulty in taking in the whole scene, of following the kaleidoscopic pictures that pass before the eyes without intermission from beginning to end of the spectacle, of following the graceful movements, of visually comprehending the gorgeous display of the colouring of the Oriental costumes of the hundreds upon hundreds of performers. The high-pressure gas lighting is mainly instrumental in facilitating this whole appreciation and enjoyment of the living and ornate picture in Nature's own setting. The safety of public and performers is also a consideration; and it is ensured by the reliability of gas lighting.

Altogether twenty-four high-pressure Keith inverted lamps, each of 4500-candle power, are employed in lighting the vast arena; and thus altogether the lamps diffuse an illumination over the space and among the buildings equal to, in the aggregate, 108,000-candle power. One object in view was to produce the same effect as that of theatre stage lighting—that is to say, to have the spectators sitting in comparative darkness, without light in their eyes, and yet have the scene in all essential parts brilliantly lighted, with other parts toned down, suitable to the purpose where a more sombre effect is required. On the extreme left and right of the foreground of the large area are groups of six of the lamps, mounted on columns 21 ft. 6 in. high, each lamp having its own large, curved corrugated reflector, with white interior. The reflectors shield the eyes of the spectators, and direct the light (the corrugations give a large reflecting surface) over the ample expanse of open ground between the stand and the Palaces, and the gloomy heavy walls of the fortress of Pekin. Each of these groups of light represents 27,000-candle power; but the reflection of the rays from the rear of the lamps probably increases this effective candle-power by 40 per cent. or so. The other twelve lamps are placed between buildings, in buildings or beyond out of the line of vision, and alongside the lake screened by building or reflector from the eyes of the spectators. The band-stand is lighted by means of two low-pressure Sugg "Regent" lamps with parabolic reflectors, which throw a good light on to the music. There are eight flame arc lamps on standards on the top of the extreme back part of the Grand Stand; but they are more ornamental than useful. The high-pressure gas-lights were extinguished after a recent performance to show us this; and it was seen that the flame arcs had no real place in the lighting of the vast ground stage or the buildings. The arc lights were then extinguished and the high-pressure gas-lights turned on; and without the arc lamps there was no apparent difference in the general illumination. For local scenic effects, there are immediately in front of the Grand Stand three cabins, containing electric projectors, with media for giving colouring effect when required. Two separate 2-inch mains have been laid to supply the high-pressure gas-lamps —the twelve in the foreground of the arena being served by one of them; and the twelve scattered lamps being supplied from the other main. The lamps at the beginning of the evening display are supplied with gas, at about 80 inches pressure, from a small compressing-station in the North Tower Gardens, which is part of the high-pressure installation used at the Festival of Empire Exhibition last year when the main compressing plant situated near the Penge Entrance was not running. When the latter plant is brought into use for lighting the grounds, the "load" required for

Another Scene in the Chinese Pageant (under High-Pressure Gas Lighting) at the Crystal Palace.

[The Fortress Walls of the City of Pekin are not seen in these views.]

the Chinese Pageant ground is automatically transferred to it from the North Tower plant. Reminder may be given that the latter plant consists of a Keith "A" compressor coupled to a ¾-horse power gas-engine, and a "D" size compressor also coupled to a gas-engine. The large plant at the Penge Entrance station consists of two sets of "F" compressors driven by "National" gas-engines; either one of which is sufficient for supplying all the lamps in position in the grounds and the Palace. At various points in the spectacle, the high-pressure lights have to be extinguished—such as during the lantern processions and the bombardment of Pekin; and this is instantly accomplished, and the lighting as expeditiously restored when required, from a governor-house, located at the end of the Grand Stand, in which there are two 2-inch Keith control governors. Extinguishing or re-lighting is accomplished exactly at the right moment. In the Emperor's and other palaces and pavilions, there are, for decorative effect, Chinese lanterns in which there are electric incandescent lamps; and these and part of the lamps on the Grand Stand are supplied with current from the South Suburban Gas Company's large Power House in the grounds.

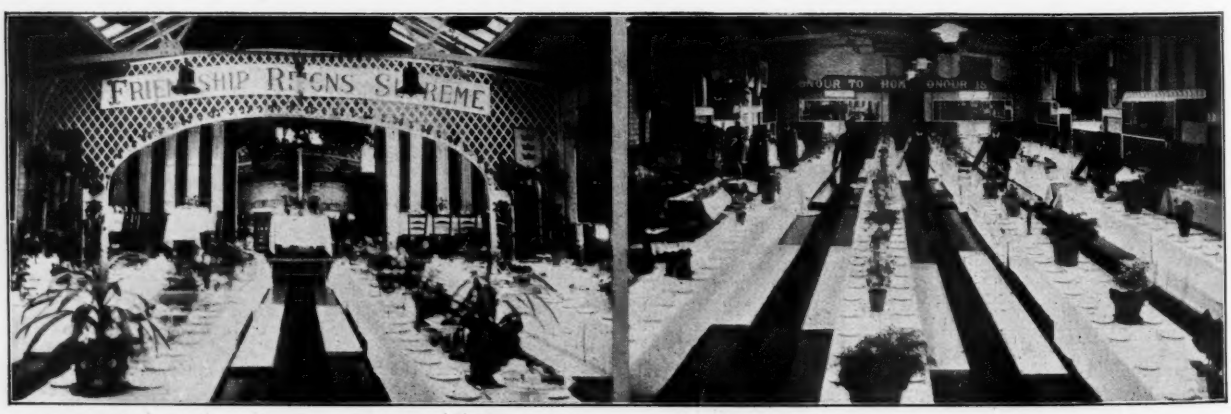
We glance round from our place in the Grand Stand. Just as there is not a dull moment in the pageant, so there is not a really dull place in the vast expanse before us, bordered by palace, pavilion, lake (with its junks and bridge), and the huge grim walls of fortress and city with its buildings of various sorts beyond. The foliage of a tree almost central in the picture stands out in relief as though in daylight; and all the architectural features are presented in well-defined detail. The façades of the buildings project clear and clean; and their, to Western notion, grotesque ornamentation is perfectly seen, though one is seated possibly more than a hundred yards away. The curious architectural squat and curved designs beloved of the Celestial, that serve as ornamentation to the roofs of palaces and dwellings, are lighted so that nothing escapes the sweep of the eyes. Every step leading to the Palaces stands out, and all who enter and leave are plainly visible. In the lake we see light and shadow; and across the bridge in the remote distance living beings are observed passing. In all the far recesses of Palaces and buildings that contribute to the scenes, all that is going on is easily discernible.

The scenes are laid in three periods—1616, 1873, and 1912; and the episodes all lend themselves to a grand picturesqueness. The exalted personages and retinues and performers generally, with their bright-coloured costumes, and all the paraphernalia and detail, are brought vividly to the eye, thanks to the facilitating character of the illumination. In the more rapid events—during the ballet, for instance, the sylph-like graceful movements of the girls and their pretty dresses are seen perfectly, though not particularly near to the Grand Stand. The art of the marvellous Chinese jugglers is witnessed to full advantage. Nothing is lost in the great spectacle—thanks to the illumination. After the display of Chinese fireworks through the dense smoke, is seen a distant high-pressure gas-lamp defying the abnormal smoke clouded atmosphere. The light from the reflector-fitted lamps illuminates the smoke in a peculiar manner, which shows the penetrating effect of incandescent gas-light in the worst of atmospheric conditions. The vibration caused by the bombardment of Pekin and the explosions during the burning of the city have caused no disaster to the globes or the mantles of the lamps—they stand unimpaired even in the region of mimic warfare. All which supply the reasons for congratulations upon the success of this introduction, under difficult conditions of high-pressure gas-lighting, into *al fresco* spectacular display ever changing in place and action over a vast area.

A few words apart in regard to the illumination of the grounds this summer season. All the high-pressure lamps that were in use last season during the Festival of Empire Exhibition, and the exhibition buildings are still in position. But all the lamps are not required this year. There are some 104 in use (128 with the pageant lights); but in some situations where the lamps are fitted with triple burners, only one of the three is being employed, and yet ample illumination is afforded. The gas-compressing plant is the same; and so is the power-house, with its three mammoth multi-cylindered engines, driven by town gas. Some slight improvements have been effected in the engines during the winter; and they are now running magnificently.

THE PRESENTATION OF MEDALS AT HULL.

THERE appeared in last week's issue (p. 659) a report of some interesting proceedings at the Hull station of the British Gaslight Company; the occasion being the presentation by the Chairman of the Company (Mr. J. Horsley Palmer), on behalf of the Directors, of medals and awards for long service to a number of officials



and workmen engaged at the station. We have since received the accompanying two photographs (of the mess-room decorated for the occasion) from Mr. George H. Elliott, a member of the engineering staff. The pictures prove clearly the interest the workers took in the matter, for they carried out the decorations entirely themselves. They also show the very fine mess-room which the Company have provided for the men. There is a splendid kitchen. The men leave their food to be cooked, and at meal-times find everything ready for them. The mess-room is so designed that smoking concerts, &c., can be held in it; and a stage can be put up in a short time, which makes the hall picturesque on such occasions.

THE LOAD FACTOR.

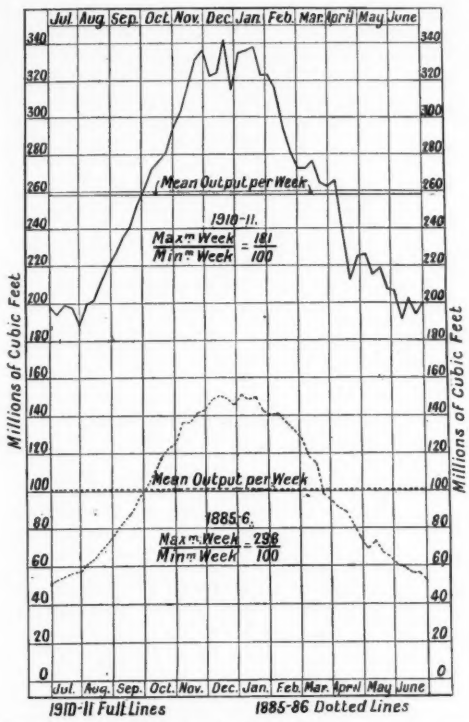
By F. Baily, in the "South Metropolitan Gas Company Co-Partnership Journal."

It is probable that in no manufacturing business is the effect of the varying relation between the rate of production and the rate of demand felt more than in the supply of artificial light; for in this there is not only a daily but also a seasonal variation. In many processes the simple expedient can be resorted to of storing when production is in excess of demand, and augmenting production from stock when demand is in excess of production—thus keeping the rate of production uniform throughout the cycle of changes in demand.

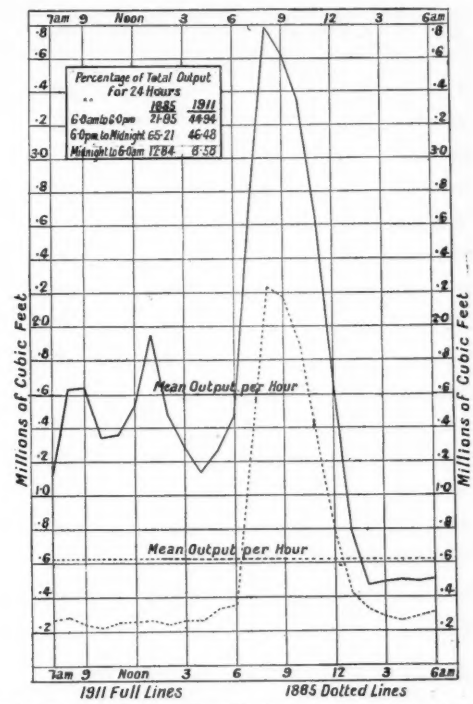
Considering the question from the point of view of the gas maker, this expedient can only be applied to the daily conditions; and even then the cost of storage bears a high proportion to the value of the gas stored. To meet the seasonal conditions, the rate of production has to be made equal to the rate of demand; and hence it must be possible to produce at all rates from minimum to maximum. The effect of this requirement on the cost of manufacture and distribution is very important. It is obvious that the plant provided must be sufficient to meet the maximum demand; and any items of cost which depend upon the capacity of the plant are invariable throughout the year. The result which follows is that these items or fixed charges (*e.g.*, interest on capital, rates and taxes, &c.) bear a varying proportion to the cost of manufacture and distribution, being highest in the summer and lowest in the winter. For this reason anything which tends to increase the demand during the summer, and so more fully employs the plant, also tends to reduce the cost.

It may be interesting to inquire what has already been done to promote uniformity between the day and night, and summer and winter demands. For this purpose a comparison is made between present-day conditions and those obtaining some time back. The accompanying diagrams show the mean daily and annual outputs of gas by our Company now and a quarter-of-a-century ago. The day and summer loads have considerably increased in proportion respectively to the night and winter loads.

In the following tables a comparison is made between the daily conditions at midsummer and midwinter, both for a Sunday and a weekday. The interesting feature of the Sunday comparison is the increase in the demand at midsummer for cooking purposes. The increase on the mid-winter Sunday must be attributed to gas-fires as well as gas-cookers.


Jul. Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar. April May June
Millions of Cubic Feet
Mean Output per Week
1910-11.
Max^m Week / Min^m Week = 181 / 100
Mean Output per Week
1885-6.
Max^m Week / Min^m Week = 298 / 100
1910-11 Full Lines
1885-86 Dotted Lines

Output of Gas per Week for the Twelve Months—July 1, 1885, to June 30, 1886, and July 1, 1910, to June 30, 1911.


7am 9 Noon 3 6 9 12 3 6am
Percentage of Total Output for 24 Hours
1885 1911
6·0am to 6·0pm 21·85 44·94
6·0pm to Midnight 65·21 46·48
Midnight to 6·0am 12·84 8·58
Millions of Cubic Feet
Mean Output per Hour
Mean Output per Hour
1911 Full Lines
1885 Dotted Lines

Output of Gas per Hour on Two Weekdays at the Spring Equinoxes of the Years 1885 and 1911.

Midsummer.—*Percentage of Total Output for 24 Hours.*

—	Sunday.			Weekday.		
	6 a.m. to 8 p.m., 14 Hours.	8 p.m. to Midnight, 4 Hours.	Midnight to 6 a.m., 6 Hours.	6 a.m. to 8 p.m., 14 Hours.	8 p.m. to Midnight, 4 Hours.	Midnight to 6 a.m., 6 Hours.
1884 .	30·0	55·2	14·8	33·8	52·2	14·0
1911 .	69·7	22·8	7·5	63·3	28·8	7·9

Note.—The maximum hourly output on a summer Sunday is now between noon and 1 p.m., whereas formerly it was during the lighting hours as on week-days.

The division of the twenty-four hours in the above and the succeeding table is arrived at by assuming that the waking hours of the community are from 6 a.m. to midnight, and by subdividing this period into hours of daylight and darkness.

The increasing use of gas for all manner of purposes, manufacturing as well as domestic, will continue to add to the day load; but, in considering this, it should be borne in mind that for about half the year, part of the day (or heat and power) load overlaps the night (or lighting) load. This *per se* tends to preserve inequality.

To add to the summer load is more difficult of accomplishment but in this it will be seen progress has been made.

Midwinter.—*Percentage of Total Output for 24 Hours.*

—	Sunday.			Weekday.		
	8 a.m. to 4 p.m., 8 Hours.	6 a.m. to 8 a.m. and 4 p.m. to Midnight, 10 Hours.	Midnight to 6 a.m., 6 Hours.	8 a.m. to 4 p.m., 8 Hours.	6 a.m. to 8 a.m. and 4 p.m. to Midnight, 10 Hours.	Midnight to 6 a.m., 6 Hours.
1885 .	16·3	73·1	10·6	16·4	74·9	8·7
1910 .	37·4	54·3	8·3	28·2	63·8	8·0

Manchester and District Junior Gas Association.—By the invitation of the Salford Gas Committee and Mr. W. W. Woodward, the Gas Engineer, arrangements have been made by the Council of the Association for members to inspect on Saturday next the Regent Road, Liverpool Street, and Albion Street gas-works of the Corporation. At the close of the tour of inspection, the party will be conveyed in special tramway cars to the Salford Town Hall, where luncheon will be provided. Subsequently a business meeting is to be held in the Council Chamber, at which Mr. E. Fearon, the Assistant Gas Superintendent at Salford, will read a paper entitled "Some Notes on Carbonization."

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Edinburgh.

The Ninety-Sixth Meeting of the Waverley Association of Gas Managers was held in the Cathedral Hotel, Edinburgh, last Friday. The chair was occupied by Mr. THOMAS BLACK, of Coldstream, in the absence of the President, Mr. James Hamilton, of Aberlady; and there was a representative attendance of members.

The HON. SECRETARY (Mr. Cuthbert Hamilton, of Loanhead) read the minutes of the previous meeting and those of several meetings of the Committee, which had since been held; and they were duly approved.

FINANCIAL STATEMENT.

The financial statement was also submitted. For the year ended April last, the income was £28 15s. 1½d.; and the balance in hand was £11 7s. 9d.

The statement was adopted, on the motion of Mr. W. S. EASSON (Jedburgh), with the remark that the state of affairs revealed was satisfactory; the balance in hand last year being only £4 14s.

ADDRESS BY MR. NAPIER.

The CHAIRMAN then called upon Mr. J. W. Napier, the Engineer and Manager of the Gas and Electricity Departments of the Alloa Corporation, to address the members.

Mr. NAPIER complied by delivering the address which, with the discussion to which it gave rise, will be found on p. 729.

ELECTION OF OFFICE-BEARERS.

Office-bearers for the ensuing year were elected as follows:—

President.—Mr. Thomas Black, of Coldstream.

Hon. Secretary and Treasurer.—Mr. Cuthbert Hamilton, of Loanhead.

Members of Committee.—Mr. W. S. Easson, of Jedburgh; Mr. Peter Blair, of Haddington; Mr. R. W. Cowie, of Dalkeith; and Mr. Black, of Tranent.

Auditor.—Mr. J. O'Halloran.

THANKS TO MR. NAPIER.

On the proposition of the CHAIRMAN, a very cordial vote of thanks was passed to Mr. Napier for his address.

ANNUAL DINNER.

At the close of the business, the members dined together, under the chairmanship of the new President. The toast of the Association was proposed by Mr. Daniel Macfie, who spoke of its long years of useful service. He referred also to the increase in the membership which had taken place within recent years, and expressed the hope that the Association, with the indications of new vitality and increased usefulness, would continue to prosper. Mr. Rutherford (Aberlady), as one of the oldest members of the Association, acknowledged the toast. Mr. Henry O'Connor proposed the health of the President, and paid a warm tribute to his capacity and ability. Mr. Black, in reply, said it would be his endeavour to add to the success of the Association. Mr. Waddell gave "Kindred Associations," to which Mr. Napier replied. The latter alluded to the growing importance of gas throughout the community, and referred in language of cordial approval to the recent activity of the Institution of Gas Engineers in the domain of parliamentary legislation. He trusted this beneficial activity would continue to grow in influence, as the gas industry had a long life before it, and had great scope for any action of the kind he had indicated. The health of the Croupiers, the Hon. Secretary, and the Auditor having been pledged, the proceedings terminated. The rest of the day was spent in social enjoyment.

AUSTRIAN ASSOCIATION OF GAS AND WATER ENGINEERS.

Annual General Meeting.

The Thirty-first Annual General Meeting of the Association of Gas and Water Engineers of Austria-Hungary was held on the 16th to the 19th of May in Agram. The proceedings opened with an assembly in the Hotel Croatia in the evening of May 16, when Professor Dr. Strache, of Vienna, in the absence of the President (Dr. Franz Heltai, of Buda-Pesth, who was prevented by illness from attending), delivered an address of welcome to the members. Those present were welcomed to the town of Agram by the Vice-Burgomaster, Herr K. Mondecar, who spoke first in Croatian and then in German.

The technical proceedings opened on the morning of May 17 under the chairmanship of Dr. Strache. Formal speeches of welcome to the Association were made by representatives of the State, the Town, the University, and various technical and industrial bodies. After thanks had been returned by the Chairman for the hearty welcome accorded to the Association, the annual report was presented and passed, and votes of thanks were given to the Secretary of the Association (Herr W. Burckhard), and to the Committees, for their work last year. The following papers were then read and discussed at considerable length:

"The New Municipal Gas-Works at Agram," by Professor F. Sandor, of Agram.

"The Water-Works of Agram," by Herr R. Vrbanic, the Manager.

"Notes on Dry Purification and on the Extraction of Naphthalene by Washing with Gas Oil," by Herr J. Bernauer, of Buda-Pesth.

"The Effect on the Curves of Candle Power and Illumination of Changes in Reflectors," by Herr Petsch, of Berlin.

"Auto High-Pressure Gas-Lamps," by Herr Ludwig Löwenstein, of Vienna.

"New Processes for the Purification of Gas," by Herr V. Schön, of Buda-Pesth.

The official report of these papers and the discussion will be issued shortly.

In the afternoon those present drove to the new Corporation Gas-Works, over which they were conducted by Herr Schönstein, the Manager, Professor Sandor, and Herr Seifert. The retort-house contains vertical retorts, on the Pintsch-Bolz system, for a daily productive capacity of about 24,000 cubic metres (about 840,000 cubic feet). The coal is conveyed to the retort-house by an electric telpher line. In the evening, the official banquet took place, and a number of toasts were given and duly honoured.

The business proceedings on the morning of May 18 opened with the election of officers and members of Council, and Committees for the ensuing year. Dr. H. Strache was unanimously elected an Honorary Member of the Association. Vienna was chosen for the venue of next year's general meeting. The following papers were then read and discussed:

"The Technical Museum for Industry and Commerce at Vienna," by the Director, Herr Paul La Ruelle.

"Practical Hints on Overcoming Constructional Difficulties in Water-Main Laying," by Herr F. Holuschka, of Vienna.

"New Inverted Gas-Burners," by Lieut. a D. Bettega, of Berlin.

"Long-Distance Ignition of Gas," by Herr Körner, of Göppingen.

A discussion also took place on the gas-works of Agram. The technical proceedings then closed with votes of thanks to the Chairman and Council. In an adjacent room an interesting and instructive exhibition of gas apparatus was arranged.

In the afternoon, those attending the meeting visited the Corporation Water-Works, and in the evening attended an early performance at the Opera. They then participated in a banquet given in their honour by the town of Agram. The members assembled again on the following day for an official breakfast, and in the afternoon the majority of them left for a collective tour through Bosnia, Herzegovina, and Dalmatia.

HELIUM AS A UNIT OF CANDLE POWER.

The following article by Dr. LEONARD K. HIRSHBERG, A.B., of the Johns Hopkins University, appeared in the "American Gaslight Journal" for the 27th ult.

The investigation of the properties of electrically conducting gases, with a view to their possible use as primary standards of luminous intensity, has been in practice for the past six years in the United States Government Bureau of Standards. Of the gases and vapours possible to use for this purpose, helium is the only one emitting light of suitable colour and duration. This light is of a yellowish-white—nearly that of the carbon filament glow lamp. The helium tube is useless after from 5 to 100 hours, according to its build and the use to which it is put. The next most available gases are sulphur dioxide and carbon dioxide. Their snow-white glow, when carrying a current, is so evanescent that they are not used.

The form of capillary tube best suited for this measurement has a bore of 1-15th of an inch with a 1-15th inch wall, and about 2·8 inches long. The bulbs at the ends are spherical, and 1½ inches in diameter. The aluminum electrodes are discs 1 inch in diameter and 1-25th of an inch thick. The bulbs may be made larger, if desirable.

The relation between the current and the emitted light, over a wide range of current (10 to 35 milliamperes) is practically a straight line. Twenty-five milliamperes is taken as a standard unit current.

The ratio of light emitted to the internal energy—the current times the potential—is not absolutely constant. The minimum volts per candle for a tube of 1-15th inch base—that is, 3·8-candle power volts—occurs when the current passing is between 25 and 30 milliamperes.

The light emitted by a helium tube, as a function of current, was later determined line-by-line for each of the six important lines of the spectrum. These all increase as the current and as the total light increase. Neither voltage nor frequency of the alternating current, nor the density of the helium, affects the emitted lights. A pressure of about 1-6th inch was adopted for the standard tubes. A test was made on a set of forty tubes of 1-15th inch bore, as described, for reproducing the light. Colour reproducibility was determined by comparing the tube spectrum with the lines of a spectrophotometer.

Photometric observations on the mean horizontal candle power per inch of capillary length are now being made in Washington by trained observers. With these standardized tubes of helium gas, it is not impossible that we shall have a unit of illumination as fixed as the pound or the kilo. for weight, the yard or the metre for length, and the Fahrenheit or Centigrade degree for changes of temperature.

INSTITUTION OF WATER ENGINEERS.

Annual Meeting at Cheltenham.

The Seventeenth Annual Meeting of the Institution was held at Cheltenham from Thursday to Saturday last week. The Gloucestershire Garden Spa gave the members a very hearty welcome; and the exploration of the numerous "beauty-spots" of the neighbourhood pleasantly occupied such time as was at their disposal after the transaction of business.

The meetings were held at the Town Hall; and there was a good attendance of members on Thursday morning, when the proceedings commenced under the chairmanship of the retiring PRESIDENT (Mr. Edward Sandeman, M.Inst.C.E.). The Mayor of Cheltenham (Mr. C. H. Margrett) was present.

A MUNICIPAL WELCOME.

The MAYOR extended a hearty welcome to the members, and said Cheltenham was very much honoured by the visit of so important a body as the Institution of Water Engineers. They must all recognize that the gentlemen before him had great responsibility. They were practically in control of the water supply of all the towns of the kingdom; and it was on the purity of this supply that the health of the community greatly depended. They felt it to be an additional honour that the Institution should visit Cheltenham in the present year, because they had elected as their President the Borough and Water Engineer (Mr. J. S. Pickering, M.Inst.C.E.). He felt that they recognized Mr. Pickering's merits, his ability, and his high standing in the engineering world. In Cheltenham also these qualities were recognized, not only by the members of the Town Council, but by the inhabitants of the borough at large. He congratulated the members on having such a President. He trusted they would have a very pleasant stay at Cheltenham, which he assured them possessed many attractions. The water supply of the town would, no doubt, be of some interest to them. They obtained water from five different sources, including an emergency supply from the Severn. He noticed that they were to visit Tewkesbury, where the Corporation were just erecting new works, and were installing what they believed to be the latest system of filtration. They hoped that when this was completed they would have a never-failing supply of pure water for all time. He saw from the programme that the members were to consider various questions affecting the water supply of towns. Their discussions could not fail to be of interest to everyone connected with municipalities, because, after all, the town councils and other sanitary authorities were responsible to the ratepayers for the provision of pure water.

The CHAIRMAN said the members were exceptionally fortunate this year in being able to hold their annual meeting in so beautiful a town as Cheltenham. The Mayor had received them with great kindness and courtesy; and on behalf of every member of the Institution he wished to offer him their very sincere and hearty thanks.

DELEGATES FROM WATER AUTHORITIES WELCOMED.

The CHAIRMAN said he wished, on behalf of the Institution, to extend a cordial welcome to the delegates of water authorities who were present for the first time. He was sure they all hoped that in future they would have very many more of them.

MINUTES OF THE LAST MEETING.

The minutes of the winter meeting, held in London on the 8th and 9th of December, were confirmed.

PRESENTATION OF PREMIUMS.

The premiums awarded by the Council for papers read last year were as follows: To Dr. Herbert Lapworth (London), "The Geology of Dam Trenches;" to Mr. G. T. Edwards (Bamford), "Portland Cement for Public Works;" to Dr. Max de Recklinghausen (Paris) and Mr. Walter Clemence (London), "The Filtration and Sterilization of Water Supply."

INSTALLATION OF NEW PRESIDENT.

The CHAIRMAN said he now had to perform a very pleasant duty—that of introducing to them his successor, Mr. Joseph Spiers Pickering, who, by virtue of his position and experience, and his labours in connection with water supply and kindred subjects, had every qualification for the position. He (Mr. Sandeman) was convinced that in him the Institution would have a President who would uphold the dignity of the chair, not only with credit to himself but also with advantage to all concerned. He wished Mr. Pickering a very happy and prosperous year of office, and had great pleasure in asking him to take the chair and in presenting him with a certificate of office.

Mr. PICKERING then took the chair amid hearty applause.

THANKS TO THE RETIRING PRESIDENT.

The PRESIDENT thanked Mr. Sandeman for his kind and generous words, and the members for their reception of them. He said he felt he lacked many of the qualifications for the presidency which his predecessors possessed; but he assured them that his greatest wish was to do all he could in the interests of the Institution. The certificate he had received would be treasured by his family in years to come, and would help to remind them, if such a thing were necessary, of the honourable position which, through the kindness of the members, he had occupied. He would now ask them to accord a hearty vote of thanks to Mr. Sandeman. He had made an ideal President; and the very eminent position he occupied as a water engineer had enabled him to add dignity to the office he had held. Mr. Sandeman's courtesy in the chair had won for him the esteem and regard of every member who had been privileged to take any part in their proceedings. Mr. Sandeman had had the most onerous task that had ever fallen to a President's lot, for during his term of office they had become incorporated. This had meant a great deal of work for the Council and the President in connection with the drafting of the Memorandum and Articles of Association; and it was mainly through Mr. Sandeman's tact and ability as President that the constitution had been accepted with unanimity by the members.

The proposition was carried by acclamation.

Mr. SANDEMAN said he felt somewhat overwhelmed by the encomiums showered upon him, and must really disclaim some of them, because a great deal of the work in connection with the incorporation of the Institution was performed by gentlemen who were much more able than himself. He would specially mention Mr. Easton and Mr. William Matthews. His own share in the matter was extremely small. Still, he thoroughly appreciated the kindness of the President in referring to anything he might have done. He hoped that in the year on which they had entered they would see far greater progress made than in any previous year. In handing over the reins of authority to the new President, he must say that he did so with a little sense of relief. It had been a very pleasant year. But one had one's own work to do; and, at times, particularly at the beginning of the year, the work had been rather onerous.

INAUGURAL ADDRESS.

The PRESIDENT then delivered his address. After expressing his deep appreciation of the honour conferred upon him by the members, and assuring them that, with their assistance, he would do all in his power to maintain the dignity and usefulness of the Institution during his year of office, he opened his address with some remarks on irrigation works. He pointed out that in no branch of engineering has greater progress been made of late years than in this, and said that probably in no branch does so much remain to be done. In China, irrigation, in various forms, has been practised for untold ages; while in India, reservoirs constructed something like 2000 years ago are said to be still efficient. In 1850, the area irrigated there was probably about 4 million acres. Brief reference was then made to a few of the most important irrigation undertakings carried out in different parts of the world —India, the United States, Mexico, Australia, and New South Wales; and this portion of the address closed with some particulars of the great works on the Nile. The remainder of the address was as follows.

MODERN RESERVOIRS.

It is only a hundred years since rapid developments began to take place in the public water supplies of this country. This is mainly to be attributed to the introduction of cast-iron pipes, which enabled water to be supplied at greater pressures. Steady progress has been made ever since, with the result that there are now few populous places without a piped supply. During the last few years, many large and important undertakings have been carried out in different parts of the world, and a brief reference to a few of these may be of interest.

The Wachusett dam, said to impound the world's largest municipal reservoir, was completed six years ago. It is built to store the water of the Nashua River as the principal source of water supply for Boston, Mass., U.S.A., as well as for twenty-seven other municipalities. The contents of the reservoir when full is 63,000 million U.S. gallons (8420 million cubic feet). The cost of the reservoir complete has been £2,115,545.

The new Croton reservoir for the supply of New York was completed about the same time as the Wachusett reservoir, and occupied thirteen years to construct. The dam is a handsome structure of solid masonry, and impounds 30,000 million U.S. gallons (4010 million cubic feet). The reservoir is only one of a series on the Croton River and its tributaries. These, with others in progress, give an aggregate capacity of about 102,000 million U.S. gallons (13,636 million cubic feet). The present supply is even now barely sufficient to meet the demands of the city, and a colossal scheme, which, it is said, before completion, will cost over £36,000,000, is in progress for bringing water from the Catskill Mountains—a distance of more than 100 miles.

The Cataract dam for the supply of Sydney—the biggest in Australia—has recently been completed. It impounds 21,411 million gallons of water (3436 million cubic feet), or nearly a thousand days' supply. Like other large dams in Australia, this dam is painfully devoid of embellishment or ornamentation; there being nothing but the outlet towers to relieve the monotony of the huge expanse of wall. The structure, though plain and bare, is strong, effective, and cheap. In commenting on the unsightliness of New South Wales dams, Mr. E. M. de Burgh describes them as bare segments of a vertical concrete cylinder wedged into the gorges without even a parapet or string-course to set them off. Happily, in this country regard is had not only to efficiency and

economy, but to the necessary embellishments which render these works of a pleasing and picturesque character; and in connection with the magnificent lakes which have been made for supplying the needs of our large cities, there is nothing inharmonious with the surrounding scenery.

The largest impounding water-works reservoirs in our own country, although exceeded in size by others in various parts of the world, are nevertheless monuments of great engineering skill, and are carried out with every regard to the requirements of the cities whose needs they serve. In making a comparison, it must not be overlooked that in this country the consumption of water per head is considerably less than in the United States. Take, as an instance, Boston, U.S.A. The earlier works were designed to supply 30 gallons* per head per day; but in 1870 the supply increased to 66 gallons per head; in 1875, to 69 gallons; in 1880, to 87 gallons; and in 1895, to 92 gallons. In the latter year, the State Board of Health reported that it would not be safe to calculate on a less requirement than 100 gallons per head per day for the next 25 years; and even this liberal estimate was speedily outgrown. Extravagance of this description would not be tolerated in this country. In my opinion, instead of providing costly engineering works to meet unreasonable demands, it is preferable to take any steps which may be necessary to prevent the misuse of water. There is probably no city in the world with a better water supply than London. Yet here the requirements of a population numbering something like 7,000,000 are amply provided for by a supply of 32 gallons per head per day.

There has been great activity in this country in recent times with regard to water supply undertakings. Within the space of a few years, three of our largest cities—Liverpool, Manchester, and Birmingham—have obtained entirely new supplies; and in a short time the Derwent Valley works, carried out under Mr. Edward Sandeman, M.Inst.C.E. (our immediate Past-President), will be augmenting the supplies of Leicester, Derby, Nottingham, and Sheffield from reservoirs having a total capacity of 3940 million gallons (632 million cubic feet). A large dam to impound 1100 million gallons (177 million cubic feet) is in course of construction at Angram for the supply of Bradford, where a serious shortage took place during the drought of last summer. The Leighton reservoir, at Leeds, which is costing about £500,000, is also nearing completion. The Alwen reservoir, which is to contain 3000 million gallons (481 million cubic feet) for the supply of Birkenhead, has been commenced. Reservoirs for the city of Cardiff are in course of construction; and when the Taff Fawr works are complete, there will be a total storage of 2200 million gallons (354 million cubic feet). Harrogate has spent nearly £1,000,000 on its water-works, and its new reservoir under construction will have a capacity of 540 million gallons (80 million cubic feet). Lincoln, after experiencing an epidemic of typhoid fever, has recently obtained a supply from the new red sandstone 20 miles from the city.

The Metropolitan Water Board have constructed covered reservoirs at Honor Oak to contain nearly 56,000,000 gallons. The opening of the Island Barn reservoir at Molesey has added 900,000,000 gallons additional storage; while a further 3000 million gallons storage will be added with the completion of the Chingford reservoir. This will bring up the total reservoir capacity for unfiltered water to 12,800 million gallons (2054 million cubic feet), in addition to which there are eighty covered service reservoirs for filtered and spring water of a total capacity of 311 million gallons (50 million cubic feet).

But it is not, of course, merely reservoir capacity which gives security as regards water supply. The new Croton reservoir of New York is more than twice the size of the whole of London's reservoirs; but whereas London is amply provided against all contingencies for many years to come, New York is compelled to push forward a gigantic and costly scheme of water supply.

QUALITY OF WATER.

The quality of a public water supply is a matter of vital importance. With the development of bacteriological science and a wider knowledge of the laws of health, public authorities in this country, as well as elsewhere, are realizing the necessity of a pure water supply. An enormous responsibility attaches to the water engineer who is called upon to supply a vast community with a commodity which is one of the first essentials to health. Water for drinking purposes and dietetic use is now laid on to almost every house in the populous parts of the kingdom, and an unwholesome supply may prejudicially affect the health of whole communities. When germs of disease are present in the water, the weak and sickly will quickly succumb; nor is there immunity even for those who may have vigorous constitutions. The water engineer knows the risk and danger of an impure supply; and as far as it is within his power, it is his duty to supply water of a quality beyond suspicion. The responsibility is not, however, all on the side of the water engineer. The water authority under whose direction he works is called upon to take its share; and in cases where obvious risks are pointed out, and the advice of the engineer is disregarded, the authority must accept the risks attaching to an unsatisfactory supply.

Whatever may be the nature of the supply itself, constant supervision by a competent engineer and a reliable staff is absolutely essential, and what is of equal importance is a systematic and methodical examination of the water by a qualified chemist. A return from water authorities throughout the kingdom as to their practice in submitting samples for analysis and bacteriological examination would, I believe, come as a somewhat startling revelation. It would, I fear, show that in the large majority of cases this very simple safeguard is, even in the case of some of the larger authorities, either neglected entirely or carried out in such a spasmodic and partial manner as to be of very little value.

The frequency with which examinations should be made must, of course, depend on the character of the supply and the system of purification. Where there is more than one source of supply, samples should be submitted from each source, and in all cases periodical examinations should be made of the water actually drawn from the service taps. Where filters are in use, not only should samples be taken from the pure-water tank, but the effluent from each individual filter should be subjected to examination at frequent and regular intervals. It is only by observing such precautions and acting upon the results obtained that a safe and wholesome supply can be assured.

SOURCES OF WATER SUPPLY.

One of the most onerous duties of the water engineer in this country is to advise on suitable sources of supply. With the continued growth of population, the limited area at his command, and the burden of taxation, which he cannot overlook, his task is becoming year by year more difficult. Many of the large cities and towns have gone far afield to obtain supplies from sparsely populated and uncultivated districts, and have acquired immense areas of land within their gathering-grounds for the purpose of preventing pollution. London, on the other hand, continues to serve its huge population from an admittedly polluted river supply, which is, however, rendered of hygienic purity by storage and filtration.

The efficiency of modern processes of purification has become so marked that it is now a debatable question as to whether water contaminated to a slight extent and undergoing a thorough treatment of purification is not safer than an untreated water obtained from what may be considered an unimpeachable source.

The following table gives a summary of the averages per 100,000 population:—

Town,	Average per Annum for Ten Years, 1892-1901.		Average per Annum for Ten Years, 1902-1911.		Average per Annum for Twenty Years, 1892-1911.	
Deep Wells.						
Wolverhampton	142	Average 144	42	Average 56	92	Average 100
Birkenhead	174		79		126	
Southampton	118		47		82	
Upland Surface Water.						
Liverpool	173	Average 110	61	Average 52	117	Average 81
Manchester	95		60		78	
Plymouth	62		42		52	
Birmingham	112		43		77	
River Water Filtered.						
London	77	Average 95	35	Average 37	56	Average 66
Reading	38		28		33	
Worcester	67		35		51	
Exeter	199		51		125	
Average of towns other than London	128		54		91	
Average of 214 towns	111		51		81	

The figures show a somewhat high typhoid rate in Worcester up to 1894, and an exceptionally high rate in Exeter up to 1900; but, notwithstanding these figures, the averages are the lowest in the towns deriving their supplies from rivers. In 1895 and 1902, Worcester and Exeter respectively installed an additional area of filter-beds. During the last ten years there has been a general reduction in the typhoid rate, as compared with the previous decade, not only in each of the cities and towns specially mentioned, but in the 214 towns from which statistics have been obtained. This is a gratifying result, and is probably due in a great measure to improvements in the water supplies which have taken place generally throughout the country.

PURIFICATION BY STORAGE.

The purification of water by storage has of late years been the subject of much interesting discussion. The research work of Dr. Houston in connection with the storage of the river waters supplying London has been rewarded with most important and gratifying results, which are beneficial not only to the Metropolitan Water Board, but to all engaged in water supply undertakings. Dr. Houston has shown that the microbes of disease and those which are indicative of sewage (*B. Coli*) perish rapidly in stored water. In about three weeks, speaking generally, the safety change is complete, and dangers imminent from sewage pollution are reduced to a minimum. The water is also in a better state from a chemical point of view, and nearly the whole of its sediment is removed.

These conditions refer especially to river waters; but they are no doubt applicable generally to waters from gathering areas which are subjected more or less to sewage contamination.

But while such contaminated waters will improve by storage, filtered waters, and waters from underground and other sources not liable to pollution, may actually deteriorate by impounding in open reservoirs. Where practicable, waters of this description should, if storage is necessary, be kept in covered reservoirs.

The storage of water in open reservoirs sometimes gives rise to trouble owing to the growth of algæ, and some classes of water so

*U.S. gallon = 0·833 Imperial gallon.

affected which do not undergo subsequent treatment may become unfit for use. It is quite a common practice in the United States to apply copper sulphate to water of this description, not only to destroy the algæ, but to prevent their growth; and the results appear to justify the treatment. This remedy has not found much favour in this country, although in a few cases it has been applied successfully, particularly at Newport and in the neighbouring city of Gloucester.

MECHANICAL FILTERS.

The mechanical type of filter is becoming extensively used in this country. It possesses advantages over the slow sand-filter with regard to space occupied, initial cost, and working expenses, and may frequently be used where a slow sand-filter would be impracticable. The filter is especially serviceable where the use of a coagulent is desirable to remove peaty and other discolouring matter, as, in addition to producing a bright filtrate, the chemical has the advantage of assisting the bacteriological purification of the water. The pressure-filter has been given preference over the gravity-filter, chiefly because it can be introduced on the service-main without much loss of head. Where, however, sufficient head is available, this practice is not to be recommended, as it is obviously preferable to keep the filtrate as closely under observation as possible. Mechanical filters, when properly arranged, will give equally good results as slow sand-filters. The weak point in both types is their impaired efficiency after cleaning; but whereas the former generally have to undergo this operation very thoroughly at least once a day, the latter may continue for weeks without even the surface film being removed.

PRE-FILTERS.

In many cases where ordinary slow sand-filters are in use, I am of opinion that mechanical filters might be introduced as pre-filters with considerable advantage. Experience has proved beyond doubt that after the filtering skin has been removed a filter loses much of its power to remove the micro-organisms from the water; and it is only after running the water to waste for some time and reducing the speed of filtration that it gradually regains its efficiency. These precautions are recognized as necessary by all water engineers; but those who have charge of filters realize the difficulty of carrying them out in practice, particularly as there are no means of really testing the work a filter is doing except by a bacteriological examination of the filtrate. As a safeguard, then, against the inefficiency of a freshly-scraped filter, and as a second line of defence, as it were, against the passage of pathogenic bacteria into the supply mains, pre-filters are of the greatest value. In his Presidential Address, Mr. W. H. Humphreys stated that water from the River Ouse for the supply of York, after undergoing purification by means of gravity pre-filters and ordinary sand-filters, gave an average reduction in bacteria of 99·1 per cent. over a period of three years.

The most complete form of filtration is that known as the Puech-Chabal system. Many members had the privilege of inspecting an installation of these filters (dealing with 7,000,000 gallons of Seine water per day) on the occasion of the visit of the Institution to Paris five years ago. This plant is fully described in the "Transactions." Briefly stated, it consists of a series of beds acting as strainers and composed of gravel of graduated coarseness (which take the place of the usual storage reservoir), a group of coarse-sand pre-filters, and finishing beds of fine sand. Owing to the efficiency of the strainers and pre-filters, the finishing filters require very little cleaning; their surfaces being scraped only two or three times a year. This is in striking contrast to the usual type of filter-bed, which generally only runs for a few weeks without cleaning.

STERILIZATION.

Although a high standard of purity is now generally demanded, the time will probably come when nothing short of complete sterilization will be acceptable. Many substances have been found which are capable of destroying infectious germs; but their application to drinking water has been rendered objectionable owing to a harmful residue left in the water after treatment. The use of ozone is not attended with this difficulty; and in recent years this has been adopted for the sterilization of the water supplies in many large towns. The chief disadvantage is the cost of working; and, until this can be greatly reduced, the process is not likely to be extensively employed in this country. The use of hypochlorites for the sterilization of water has met with success; and this treatment has the advantage of being comparatively inexpensive in working. During the memorable epidemic of typhoid which occurred at Lincoln in 1904-5, the water supply was, on the advice of Dr. Houston, sterilized with "Chloros" (an electrolyzed solution of common salt), which proved to be efficacious. The bactericidal action of the ultra-violet rays has also been applied to the sterilization of water on a fairly large scale, and papers on this process were recently read before the Institution. An interesting paper has also been submitted on what is known as the "De-Clor" system, in operation at Reading. Through the agency of a minute dose of chlorine the objectionable bacteria are destroyed, and the residual chlorine is eliminated by means of charcoal placed within the filters. The "De-Clor" apparatus takes the place of ordinary sand-filters, the river water only undergoing preliminary treatment through coarse pre-filters.

PUMPING PLANT.

Considerable progress has been made in recent years in the development and design of water-works pumping plant; and the engineer has now a variety of different types of machinery suitable for his requirements to select from. Economy in working expenses is, as a rule, the main object to be aimed at; and it frequently happens that to effect this a large expenditure of capital on modern machinery to replace plant which, though in good working order, is of an obsolete type, may be entirely justified by the improved results obtained.

As an example of the efficiency of modern pumping machinery, the result of the official tests made by Professor Orr, in 1908, of one of four engines supplied by an English firm to the Rand Water Board, South Africa, may be mentioned as of interest. The mechanical efficiency given was 93·4 per cent. on a lift of 960 feet, and a duty of 183 million foot-pounds per 1000 lbs. of steam at 183 lbs. pressure above atmosphere superheated to 120° Fahr. The results were based upon water actually delivered at a speed of 41 revolutions per minute. Mr. Alfred Towler, in a paper read before the Institution, referred to these results as constituting the world's record for minimum steam consumption against water delivered. The figures are instructive, as showing the high efficiency to which modern pumping machinery has been brought. But in determining the probable economy of the plant, the water engineer has to bear in mind not only the duty he may expect to get from it in actual practice, but the whole of the annual costs for fuel, labour, maintenance, interest, and sinking fund charges; and a consideration of these and the conditions of pumping must guide him in the choice of the most suitable type of machinery.

A matter of great importance as affecting the working expenses of a pumping plant is the quality of the fuel. It is obviously the duty of the engineer to obtain the most suitable fuel at the lowest possible price. The usual practice of purchasing coal of a specified description at a fixed price per ton, without any regard to its varying calorific value, is unsatisfactory. No colliery can be relied upon to produce a uniform grade of fuel; and unless regular tests are made at the pumping-station, the water engineer cannot be sure that he is getting value for the money he is paying. The only satisfactory method of purchasing coal is on a thermal basis. It is a practice which has made most progress in America; and it is also making some headway in this country and on the Continent. Under this system, the purchaser buys heat-units instead of tons of coal, and the price rises or falls according as the fuel actually delivered yields, on testing, a larger or smaller number of B.Th.U. than that chosen as the standard.

Up to the present time, no other motive power has equalled that of steam for facility and smoothness of starting, variability of speed, and general reliability. Steam-engines can be coupled direct to pumps, while internal combustion engines and electric motors must necessarily drive through gear reduction. Gearing has, however, in the last few years greatly improved in efficiency and quietness of running.

The recent coal strike has shown the necessity of securing an alternative fuel supply not only in connection with water-works pumping plant, but for the numerous other power purposes for which coal is used in the great industries of the country. Such an alternative will possibly be found in liquid oil fuel. Where steam-engines are already in use, it may be found practicable either to equip the existing boiler furnaces with nozzles for burning crude oil or provide separate oil-fed furnaces. Oil in any case is likely to prove a useful substitute; and it is by no means improbable that it may ultimately supersede coal as fuel for power production. Since its introduction some fourteen years ago, the Diesel oil-engine has been greatly improved in design and construction, and it is now extensively used. Unlike the steam-engine, it requires no auxiliary plant, but converts the heat of the natural fuel into work in the cylinder itself. There is reason to believe that crude oil can be obtained in almost unlimited quantities, and at a cost to make its use practical on a large scale; and should this be proved beyond doubt, the recent stoppage of the coal supply will have given a decided impetus to the use and application of an alternative form of fuel.

ENGINEERING STANDARDS COMMITTEE.

The advancement of engineering could scarcely be shown in a more marked degree than in the establishment of the Engineering Standards Committee—an organization which is worthy of a foremost place among the great national institutions of the present century. The leading technical societies and the manufacturers of this country are, happily, co-operating in order to bring about a standardization of designs and methods in engineering practice, the want of which has hitherto resulted in enormous waste of money, and has placed the manufacturers of this country at a disadvantage in foreign competition.

Water engineers have reason to be grateful to the Committee for the standard specification which has been produced for Portland cement—a material which plays so important a part in most of the structural works with which they are concerned. The issue of this specification has not merely been a convenience to the engineer and manufacturer, but it has brought about an immense improvement in the quality of cement. In order to obtain the high quality demanded, manufacturers during the last few years have had to revolutionize their methods and replace their plant with machinery designed on the most modern scientific principles. The processes of mixing, of burning, and of grinding have undergone much alteration, but perhaps the greatest improvement is the new and additional process of hydration. It is claimed that this operation achieves in a scientific, rapid, and efficient manner what aëra-

tion has only imperfectly effected in the past. For many years, it has been the general practice to specify that cement should be stored in bulk on the works for some weeks for the purpose of undergoing aëration. Some engineers still consider this precaution necessary, notwithstanding the extraordinary developments and improvements in the processes of manufacture; but the opinion appears to be getting more general that if cement is obtained of the high standard required by the new British specification, aëration on the works may safely be dispensed with.

Another important matter on which the Engineering Standards Committee have been engaged, and which was initiated by our own Institution, is the standardization of cast-iron pipes. The work is now well advanced, and it is hoped that the standard specification will be issued at no distant date.

WASTE OF WATER.

The waste of water is a subject which has been frequently discussed at our meetings, and its importance cannot be too strongly urged. It is a remarkable fact that people who are accustomed to observe the strictest economy in other things, regard wastage of water with indifference. The average householder would deem it the greatest extravagance to obtain a gallon of milk each day when his family's requirements would be met by a quart; yet he would probably not be concerned with the trickling of water from a defective tap, although the value of the water wasted might be much more than that of the unused milk. In the one case, he suffers direct pecuniary loss; in the other, his pocket is only indirectly affected. There is no remedy for such waste except thorough and systematic house-to-house inspection, followed up with the immediate repair of defective pipes and fittings. The supply of water for domestic purposes by meter is not likely to find favour in this country; and we are probably committed for a long time to come to the rough-and-ready practice of charging for water on the value af the property supplied. The question as to the quantity of water per head which may be regarded as reasonable must depend on the circumstances of each particular supply. Where every gallon of water has to be pumped and the supply is limited, the prevention of waste is necessarily more important than in the case of an unlimited supply by gravitation.

Bye-laws for the prevention of waste would appear to the most casual observer an absolute necessity; yet at the present time there are many water authorities who have no legal power to make such bye-laws. The Institution has frequently drawn attention to this, and urged the necessity for a short Act embodying the necessary powers.

One of the best methods of avoiding waste and reducing the consumption of water to a minimum is in operation under the Consett and Weardale Water-Works Company. Mr. Robert Askwith, M.Inst.C.E., the Engineer, states that, for over thirty years, the Company have undertaken the repair and renewal of service-pipes and taps upon payment of a shilling per annum for each draw-off tap. This has been taken advantage of by nearly all the consumers, and the Company have profited by keeping the domestic supply down to the exceedingly low average of 9½ gallons per head to a population of 360,000. It is a practice which might be followed with advantage by all water authorities if the necessary legal powers were available.

THE INSTITUTION.

The past year marks a new era in the history of our Society, inasmuch as we have become a recognized corporate institution, and our powers have been greatly increased under new Memorandum and Articles of Association. While we have thus attained to a higher status and a more important position, we have accepted greater responsibilities; and it now rests with each individual member of the Institution to assist in the promotion of the objects we have in view. Those of us who have been connected with the Institution since its inception, and can look back to the time when the water engineers of this country had no facilities for meeting as a body and few opportunities of becoming acquainted with the work of their colleagues, can fully realize the usefulness of the Institution both to its members and to the water authorities whom they serve. The splendid record of sixteen years' work is shown in our yearly volume of "Transactions;" and even if our efforts had been confined to the production of the valuable papers and discussions which these contain, we could claim that our Institution has rendered very great service in matters affecting the public water supplies of the country.

The advantages of attending meetings of the Institution are so obvious to its members that it is scarcely necessary to allude to them. But it is very desirable that water authorities should be brought into closer touch with the work of the Institution, so that they also may realize these advantages; and with this object in view, the Council have for the first time invited a limited number of delegates to attend the annual meeting.

When it is considered that the first object of the Institution is "to promote the advancement of water engineering in all, or any, of its branches, and all matters connected with or relating to water undertakings," and, further, that its meetings are held for the purpose of discussing papers on water-works matters and visiting works of water supply, there should be no hesitation on the part of water authorities, not only in asking their engineer to attend the meetings, but in defraying his expenses in doing so. The stay-at-home engineer is not likely to be so well qualified to give advice as the engineer who takes advantage of the facilities afforded to widen his experience and to profit by the practice of others engaged in similar work; and it is manifestly unreasonable that he should be expected to acquire such knowledge for the benefit of his authority at his own expense.

The services of engineers engaged under water-works companies are, as a rule, much better appreciated and more suitably recognized than in the case of engineers to public authorities. The directors of a company know that the success of their undertaking depends almost entirely upon the ability and the energy of their engineer, and, being financially interested in the undertaking, they appreciate his services from a purely business point of view. Public bodies may value the work of their engineer, yet, however willing they may be to reward his services, they not infrequently sacrifice their personal conviction to a fear of public opinion, with the result that not only does the official suffer, but in all probability the undertaking also.

Engineers to public bodies who are entrusted with the carrying out of large engineering works too often meet with discouragement from the authority which, above all others, should act as their strongest supporter. In giving their sanction to a loan for public works, it is the practice of the Local Government Board to make a condition that no payment out of the loan is to be made to a salaried official. This means that, whatever the magnitude and importance of the works which the engineer may carry out, and although these may be entirely outside his ordinary duties, the authorized loan cannot include any fee to which his authority may consider his added responsibilities justly entitle him. The stipulation is rendered all the more objectionable by a proviso which invariably follows, that it is not to apply to the clerk of the authority. It is difficult to understand why this invidious distinction is made, in view of the fact that the legal work in connection with the undertaking is usually insignificant as compared with the engineering work, and it is still more difficult to conceive why the authority may not pay their own engineer out of the loan, and yet may do so in the case of a consulting engineer or another municipal engineer who may be asked to confer with him. The contention that the salary of an official should cover special services in connection with large and important undertakings outside his ordinary duties, is manifestly unfair. The works being of a permanent character and provided for out of a loan, the engineering costs should also be a charge on capital.

The report of the Water Areas and Statistics Committee presented at the last winter meeting of the Institution sets forth the important work on which the Council have been engaged for some time past. The report deals with many of the unsatisfactory conditions which exist with regard to public water supplies, and points out the remedies which it is suggested should be adopted by the Legislature. The establishment of a central authority and district boards to control the allocation of new sources of supply, and to deal with questions of national importance relating to public and private supplies, cannot be indefinitely postponed; and the recommendations made by the Institution on this important matter will no doubt prove of great value. The collection of statistics relating to water undertakings which has recently been undertaken by the Local Government Board has always been strongly advocated by the Institution; but it is to be regretted that the information invited is so limited in character.

The increased activity of the Institution, particularly in connection with the Water Supplies Protection Bill and the National Insurance Bill, and in other matters affecting the interests of water authorities, has necessitated an increased expenditure; and last year, for the first time, there was an adverse balance on the year's working. It is the opinion of the Council that the work which has been undertaken cannot be curtailed without sacrificing much of the influence and usefulness of the Institution; and it is necessary therefore to adopt some means of permanently increasing the revenue. After the most careful consideration, the Council have decided to ask members of the Institution to consent to a raising of their annual subscription, and it is hoped, in the interests of the Institution, that this proposal will be readily accepted.

The following table shows the number of members on the 1st of January during the past five years:—

Class.	1908.	1909.	1910.	1911.	1912.
Honorary members . . .	2	3	3	3	3
Members	206	207	214	221	227
Associate members . . .	108	116	121	125	130
Associates	36	39	38	38	36
Total	352	365	376	387	396

Though the increase is somewhat slow, it has to be remembered that the number eligible for membership is limited, and that for some time past the standard of qualification for admission to the various classes has been raised. At the present time, the Council have under consideration the question of forming a class for students; and I firmly believe this course to be very desirable. The Institution is the only body representing the water engineers of the country; and I think it should include in its ranks not only the engineer whose experience has qualified him for membership, but the young engineer who is intending to follow this branch of the profession. Later on I hope it may be found practicable to institute a voluntary examination for water-works engineers. This appears to be necessary, in view of the fact that there is at the present time no recognized qualification for assistants to water

engineers other than that of experience; and I hold that theory and practice are equally important. Further, I am of opinion that the usefulness of the Institution might be materially increased if a larger number of visits were arranged to engineering works. The advantage of this is beyond question; and I hope that the matter may be favourably considered by the Council.

In conclusion, may I express the hope that the coming year may be one of progress, and that our Institution will continue its useful work for the benefit of its members and to the advantage of the authorities who are entrusted with the responsible control of the water undertakings of this country.

Mr. W. MATTHEWS (London) moved a hearty vote of thanks to the President for his address.

Mr. C. H. PRIESTLEY (Cardiff) seconded the motion; and it was carried unanimously.

NEW MEMBERS.

The Scrutineers of the balloting-lists reported that the following gentlemen had been added to the roll of membership:—

Members.—Mr. C. W. Bennett, of Broughton (Cheshire); Mr. W. J. E. Binnie, of London; Mr. F. G. Fairbank, of York; and Mr. T. Moulding, of Exeter.

Associate Members.—Mr. S. Hall, of Aberdeen; Mr. J. A. Hutchinson, of Torquay; Mr. J. H. Montgomery, of Llanelly; and Mr. W. Young, of Epsom.

Associate.—Mr. W. Thomas, of London.

PAPERS READ.

The papers read and discussed during the meeting were:

"The New Water-Works for Skegness," by Mr. PERCY GRIFFITH, M.Inst.C.E.

"Rates and Taxes on Water-Works Undertakings," by Mr. DONALD DINWIDDY, F.S.I.

"The Rating of Water Undertakings," by Mr. ARTHUR VALON, Assoc.M.Inst.C.E.

"The Hinckley Water-Works," by Mr. E. H. Crump, Assoc. M.Inst.C.E.

"The Gloucester Water-Works (Witcombe Reservoirs)," by Mr. R. Read, Assoc.M.Inst.C.E.

"Use of Sulphate of Copper in Purifying Water Supplies," by Mr. G. Embrey, County Analyst of Gloucestershire.

"Self-Pollution of Water by Natural Growths," by Dr. J. H. Garrett, Medical Officer of Health for Cheltenham.

"The Geology of Cheltenham, with Special Reference to the Water Supply," by Mr. L. Richardson, F.R.S.Ed., F.G.S.

Abstracts of the papers, with some notes of the remarks made upon them, will appear in subsequent issues of the "JOURNAL."

REPORT ON WATER REGULATIONS.

On the resumption of business on Saturday,

The PRESIDENT read the report of the Joint Committee on Water Regulations, which will be given in a subsequent issue.

VOTES OF THANKS.

Mr. ASHTON HILL (Birmingham) moved a vote of thanks to the Mayor and Corporation of Cheltenham for welcoming the members to the town, and for the opportunity afforded of inspecting the water-works, as well as for the use of the Town Hall.

Alderman BIRD, ex-Lord Mayor of Cardiff, seconded the proposition, which was carried with applause.

The PRESIDENT proposed a vote of thanks to the Mayor and Corporation of Gloucester for giving the members an opportunity of visiting the Witcombe reservoirs.

Mr. PERCY GRIFFITH (the Secretary) seconded the vote, and it was heartily accorded.

On the motion of Mr. W. JONES (Pontypridd), the officials were thanked for their services.

Similar votes were accorded to the authors of the papers, and to the President; and the proceedings closed.

ANNUAL DINNER.

The annual dinner was held at the Town Hall on Friday night; a large company being present. The PRESIDENT occupied the chair, and was supported by the Mayor of Cheltenham and a number of leading local residents.

The loyal toasts having been honoured,

Dr. SAMUEL RIDEAL proposed "The Mayor and Corporation of Cheltenham." He said the motto of the borough was "Salubritas et Eruditio;" and he felt sure that the first word had some reference to the waters in the neighbourhood. Their Mayor seemed to be very keen about water undertakings; and he (Dr. Rideal) was glad to see that the town had a Corporation who were so intelligent and enterprising about a matter which was so important from the point of view of public health as the provision of an ample supply of pure water. He hoped the supply recently inaugurated would soon be one of the most efficient in England.

The MAYOR, responding to the toast, said he was glad to hear that Dr. Rideal approved of what they were doing in Cheltenham in the matter of filtration. As he had previously stated, they believed that when the works were completed they would have a pure supply of water for all time. Alluding to the services the President had rendered to the town, he said they had heard a great deal lately about doing justice to those on the lower rungs of the ladder. But those who were higher up were also entitled to fair play; and he was delighted that the Corporation of Cheltenham had recently recognized Mr. Pickering's services in a substantial manner. He thanked the company for the way in which they had received the toast, and expressed the hope that, notwithstanding the unfortunate weather during the previous two days, they had enjoyed their visit to Cheltenham.

Alderman NORMAN proposed "The Institution of Water Engineers." He said Cheltenham had special reason to be grateful to these gentlemen. Though the town was surrounded by hills, the water which ought to come from there broke out the other way. They had, however, overcome the difficulties which had oppressed them so long; and for this they had to thank the engineers they had consulted. Among them was the late Mr. Thomas Hawksley, whose advice that they should go to the Severn for water had now been vindicated.

The PRESIDENT responded to the toast.

During the evening, selections of music were rendered.

VISITS TO WORKS.

THE TEWKESBURY PUMPING-STATION.

On Thursday afternoon, by invitation of the Cheltenham Corporation, the members and their friends visited the Tewkesbury pumping-station. The weather was unfortunately wet; but the party none the less spent an interesting afternoon in inspecting the works. Tea was served in a marquee.

The Severn water, owing to its turbid character and the absence of a storage reservoir, is difficult and costly to deal with. Filter-beds have given good results; but they not infrequently become thickly coated, and have to be cleaned after a few days' working—causing the waste of a large quantity of water, and necessitating a considerable amount of labour. In order to overcome these difficulties, and provide for a larger supply, a system of preliminary treatment in the form of rapid pre-filters is being introduced. These filters, which are of the gravity type, are being installed by the Paterson Engineering Company, of London. They are capable of dealing with at least a million gallons of water in 24 hours. After leaving the pre-filters, the water will be passed through ordinary sand filters, of which there are six, having a combined area of 2816 square yards. An additional filter is in course of construction; and when this is complete the total area will be 3566 square yards. When the whole of the filters are working, the speed of filtration in dealing with a million gallons of water a day will be at the rate of 2½ inches per hour. When one of the largest filters is undergoing cleaning, the rate of filtration will be increased to 3·2 inches per hour. It is anticipated that the slow sand filters will work for a long period without cleaning, as the pre-filters are expected to remove all the visible suspended matter. It is also hoped that by the use of a coagulant the objectionable brown colour of the water will be greatly reduced. The pumping plant consists of two sets of Worthington triple-expansion steam-pumps; one set being capable of delivering 50,000 gallons, and the other 33,000 gallons of water per hour. A beam-engine pump, delivering 24,000 gallons per hour, is used for supplying Tewkesbury when the Worthington engines are not in use for pumping to Cheltenham. The boilers work at a pressure of 150 lbs. per square inch; and the steam is superheated to about 120° Fahr. The pressure on the pumping main, when delivering water to Cheltenham, varies from 150 to 200 lbs. per square inch, according to the quantity raised. The high pressure of water is found very useful in connection with the sand washing, which is carried out in an economical manner by one of Messrs. Pettit, Garside, and Webster's washers.

THE DOWDESWELL AND HEWLETTS RESERVOIRS.

The weather was again very unfavourable for outdoor excursions when, on Friday, the members drove to the Dowdeswell and Hewletts reservoirs of the Cheltenham Corporation.

THE WITCOMBE RESERVOIRS.

On Saturday, the members drove to Witcombe, and, by invitation of the Mayor and Corporation of Gloucester, inspected the impounding reservoirs and filtration plant.

Gas Production from Unmined Coal.—Just after Sir William Ramsay made his startling proposal, at the recent Smoke Abatement Exhibition, to produce gas at the bottom of the mine, and utilize it at the surface for driving engines for the generation of electricity for transmission all over the country, it was stated that permission had been given for a trial of his scheme at a pit in this country. According to some remarks made by him in the course of a speech at the dinner of the Institute of Mining Engineers last Thursday, the experiment is also to be tried in America.

Fuel Testing and Gas Analysis Plant at the Liverpool University.—The new Harrison-Hughes Engineering Laboratories at the University of Liverpool include in their equipment four different kinds of gas-producers—one of the suction type, for gasifying bituminous coal, peat, and different sorts of trade refuse; two for dealing with anthracite or coke; the fourth (of the down-draught class), for making experiments on the gasification of bituminous fuel. In the internal combustion section of the laboratories there are three gas-engines, of 40, 24, and 8 B.H.P. respectively; the smallest having been constructed by the students. Arrangements for fuel testing and gas analysis at the laboratories are of the most complete character. The laboratories have cost, including equipment, about £40,000, which comes out of funds provided by Mr. T. Fenwick Harrison, Mr. J. W. Hughes, and Mr. Heath Harrison, shipowners of Liverpool. The late Mr. Thomas Harrison (father of Mr. Heath Harrison, and uncle of Mr. T. Fenwick Harrison, established the University's Chair of Engineering in 1886, with a gift of £10,000.

HOT WATER & ELECTRICITY SUPPLY COMBINED.

A scheme for the establishment of a combined hot water and electricity supply for private houses was brought under the notice of members of the Royal Sanitary Institute by Dr. R. HERZFELD in a paper read at one of the recent sessional meetings, and printed (with a report of the discussion upon it) in the current number of the Society's "Journal." The following abstract of the paper gives an indication of the author's proposals.

Dr. Herzfeld began by reminding his audience that a good many improvements have lately been introduced in the domestic arrangements connected with lighting, cooking, and the supply of hot water; but he said they have not received the general support they deserved. With respect to the last matter, while, under present conditions, many things are taken into the house which could be produced at home, it is astonishing to find people still insisting on making water hot on the premises. The reason for this is the existence of the popular belief that hot water, as now produced, does not cost anything, as the boiler is heated by the waste gases of the kitchen fire. In reality, however, it costs a great deal. The kitchen fire, like all open domestic fires, has a very low calorific effect—hardly exceeding 10 per cent.; and very often (according to Dr. Herzfeld's estimate, about half the time) the fire is only lit for the purpose of getting hot water. If this had not to be provided, the coal-fired kitchen would long since have been superseded by cleaner and better appliances. Hot water is not a mere bye-product; for money has to be spent on coal and labour to get it. Moreover, the boiler must be cleaned periodically, and repairs are not too seldom required with the London water. Both operations involve expense and a general dislocation of household work. Those countries which have lately adopted the English standard of comfort have not imitated the combined kitchen range to any large extent, but have used the public gas supply for providing the hot water. Dr. Herzfeld thinks it must be admitted that these installations have reached a fair degree of perfection. The general experience, however, is that they require skilled handling, and that they cannot safely be left with any but conscientious people. This clearly indicates that people recognize that they do not get hot water for nothing.

According to Dr. Herzfeld, the ideal way of providing hot water is from the outside. Technically, the problem is comparatively simple, and has long been solved in practice in asylums and hospitals built on the isolated houses system, especially on the Continent. The main difference between this and the single-house system is that gravity alone is not sufficient to effect the proper circulation. The water must be pressed through the pipes by means of a pump, and replaced automatically by the pressure of the public water-mains. The loss of heat in areas of moderate size is insignificant, as long as a suitable system of insulation is adopted for the pipes. This has been proved in many private installations. The circulating pumps should have a somewhat variable speed according to the demand for the water.

As an example of what he proposes, Dr. Herzfeld took a four-cornered block of fifty houses for families in comfortable circumstances with an annual rent of £140 per house. The average consumption of hot water in such a house for a family of five, with the usual number of servants, is 80 gallons, at a temperature of 140° Fahr. On an average, 10 per cent. of the houses are empty; so that the total daily consumption would be 3600 gallons. In order to be liberal, and to offer a material improvement on the present state, he provided for 5000 gallons, which amount should, he said, allow for a good deal of wastage, considering that the 45 households are not, as a rule, worked at full pressure the whole year through. The cold water is supplied at an average temperature of 54° Fahr. Allowing for losses in storage and transmission, a daily consumption of 900 lbs. of good coal, at 16s. per ton, would cover the demand. The generating station could be placed in any convenient position of the block, with easy access for the conveyance of coal and ashes. There would be two boilers, each of the full capacity; the combustion being automatically controlled by the temperature of the water. There would further be an electrically-driven pump, in duplicate, the speed of which would also be controlled by the temperature. The same operator could work three or four adjoining stations. The machinery would run about 17 hours every day of the year; while for the seven hours of minimum demand the storage might be relied upon. A properly-adjusted reducing-valve would control the replacement of the hot water drawn by cold water.

The author submitted the following estimate of the capital expenditure of such an installation as he had described, and of the running costs, on the assumption that a contractor would carry on several schemes at the same time.

Capital Expenditure.

Two boilers with accessories	£150
Storage tank for 2000 gallons and pipe connections in the station	35
Two electrically-driven pumps, including wiring and all accessories	68
Cold water connections	27
Pipes and house connections	550
Chimney and flue	50
Building and foundations	120
Contingencies	30
Total	£1030

Running Costs.

Coal	£126
Labour	49
Supervision	15
Oil and stores	3
Maintenance and repairs	44
Power and light	32
Depreciation (7½ per cent.)	77
Insurance, ground-rent, taxes, &c.	50
Contingencies	19
Total	£415

Allowing for 12½ per cent. profit, a sum of £544 would have to be collected from the 45 occupied houses per annum, or £12 per house. Dr. Herzfeld remarked that when it was considered that, under the old system, coal and servants' labour, continuous cleaning of the kitchen, and occasional cleaning and repairs of the boiler, must be paid for, and that with all this the service is unsatisfactory, and certainly not uninterrupted, the sum named would not seem extravagant.

Having dealt with the legal aspect of the question, which he thought would not present insuperable difficulties, Dr. Herzfeld remarked that people who are in sympathy with his scheme might object to it on the ground of cost. He suggested, however, that some heat-wasting establishment might be attached to the hot-water station, and the products therefrom utilized. There was nothing more appropriate to a block of private houses than a small electricity station, the products of which could be used on the spot, and the bye-product—the hot-water—employed for the purpose suggested. The author then indicated as follows how such an idea would work out in practice.

We have already seen that the supply of hot water from outside clears the way for the introduction of more efficient and cleaner and more convenient methods in the kitchen. We shall therefore have to provide for sufficient electricity to do the cooking, in addition to lighting and occasional heating. Numerous experiments have shown that the average daily consumption of electricity for cooking is about 0·45 unit per head, provided that hot water is available from other sources. I have therefore estimated that the average demand for all purposes of each of our 45 houses will be 4½ to 5 units per day; and the maximum load I have taken at 56 Kw. In order to reduce to a minimum the apparatus in the combined station, an arrangement should be made with the local supply company to provide a cable which would be used in case of a breakdown of the machinery. Every statutory electrical company is compelled to enter into such an agreement on terms.

The station would contain: Two steam-boilers for high pressure, with superheaters and all accessories; one steam set direct coupled with a 45 Kw. dynamo, with overload capacity of 56 Kw. for two hours, a circulating pump for 30 gallons of water per minute, an air-pump, and a boiler feed-pump; one spare boiler feed-pump; two marine-type condensers used as calorifiers; one storage-tank for 2000 gallons heated by the furnace-gases; one electrical storage battery for a capacity of 400 ampere-hours; one spare circulating pump, electrically driven; a switchboard with booster; a cold-water inlet; and the necessary pipes and cables, meters, and house connections. The most suitable voltage would be 200. It would reduce the cost of cables and wires, compared with the 100-volt system which is now in vogue in most parts of residential London. Economical lamps can now be procured at the higher voltage down to 16-candle power, which is as low as is reasonably required. Such a station, with all its connections, would cost approximately £2750 to build.

The cost of running of such a combined station, which supplies 5000 to 6000 gallons of hot water, and about 211 electrical units per day, I estimate as follows:—

Coal	£160
Labour	150
Supervision	40
Oil and stores	18
Maintenance and repairs	105
Depreciation (8 per cent.)	220
Insurance, ground-rent, taxes, &c.	75
Contingencies	28
Stand-by	26
Total	£822

As a charge to the house owners, I would recommend a flat-rate for hot water, and a combined maximum demand and unit rate for electricity for all purposes. . . . As an example, I have taken £9 per house for hot water, and £9 per kilowatt of maximum demand per annum, charging the units at 0·7d. I have further assumed that the total yearly maxima of all the houses are 63 Kw., against 56 Kw. maximum load at the power-house switchboard. The revenue would then work out as follows:—

Hot water	45 × £9	= £405
63 Kw.	at 9 p. Kw.	= 567
211 × 365 units	at 0·7d. per unit	= 224
Total		£1196

You will see from this that the charge for hot water has been materially reduced from the figure mentioned in the first example; and it should be attractive enough for every adjoining household. The electricity works out at slightly less than 2·5d. per unit—also a very low and reasonable figure which has not been offered by any of the Metropolitan supply authorities. The scheme is specially favourable to those who want to make a more liberal use of electricity without increasing their maximum demand on the station. They are being charged at 0·7d. per unit—not much more than the extra cost of the coal which has to be fired in the power-house. Finally, the contractor is left with a fair profit, which in this instance works out at 13·6 per cent. on the capital, after providing 8 per cent. for depreciation.

Another scheme put forward by Dr. Herzfeld consists in

making use of the supply of electricity the moment it comes into existence—thereby doing away with storage. The author suggested that the public supply authorities might, under this scheme, obtain current at a time in the day when it would not be economical to run one of their large sets to generate it; and in this way the equipment of the station would be greatly simplified and cheapened. The cost of the plant was estimated at £1620, and the running expenses at £598. With the revenue from hot water at £405 as before, and that for current at £361 (based on a price of 0·9d. per unit), the profit would be £168, or 10·3 per cent. on the capital.

Of the three schemes brought forward, the one last referred to might, Dr. Herzfeld thought, be looked upon as the most favourable by a good many, seeing that a substantial portion of the output of the station would be sold before the capital was spent. This remark did not, however, imply that any great risk would be involved in starting a self-contained scheme as described, even without the initial support of the whole of the adjoining house-owners. He believed that, when once the service was started, the domestics would be the best agents of the new undertaking, and would compel everybody to join. If the scheme was taken up by those engaged in providing houses for the growing population, he believed that we should soon have a capital healthier and cleaner than it now is, and that the every-day work of the household would be relieved, while the old institution of the home would be retained.

In the course of the discussion on the paper,

Mr. H. D. Searles-Wood said he had made a few inquiries as to the attitude the water authorities would take on this subject, and he was informed that, under the existing law, provided the water-rate was paid by the householder, there would be no objection to the hot water being supplied as suggested; but the difficulty would arise when the mains had to cross a public way. The local authorities and the other statutory bodies, such as gas and water companies, could only open the ground for specific purposes; and directly a hot-water company wanted to lay pipes in the roadway they would, as a rule, have to negotiate expensive wayleaves.

Mr. T. Potterton said Dr. Herzfeld had stated that the kitchen fire has a "shockingly bad calorific effect." This, in the ordinary way, undoubtedly was so, because kitchen ranges were constructed, so far as their water-heating arrangements were concerned, in such a manner that the heat utilized was only a low percentage of that which passed through the flue. The estimate given of 10 per cent. efficiency, however, was somewhat low, as the majority of modern ranges were now provided with extended boilers of the boot type, which were made in various forms; and where these were working with the dampers well under control, three or four times the efficiency named was obtainable. Generally speaking, 50 gallons storage was the limit to which an ordinary range could be applied successfully, as, though the heat from the fire was sufficient to do better service, the wastage prevented it. There were, however, other types of range boilers on the market specially designed to prevent the excessive waste referred to. As an instance of this, the speaker quoted the case of a range at a police section house in the West-End which was working with a 200-gallon storage cylinder for bath and general uses, besides furnishing heat for linen and airing purposes. In this case, some twenty or thirty baths were taken in succession, which the range fire was equal to supply without excessive fuel consumption; in fact, no more than would be occasioned by the same range having an ordinary type of boiler. On the subject of the alternative system of gas heating, Dr. Herzfeld, though agreeing that these installations had reached a fair degree of perfection, considered that they required skilled attention. Experience, however, proved that this was not so, for there were hundreds of domestic hot-water installations in London alone which were working to perfection in the hands of the ordinary servant. So far as appliances for the automatic control of the gas in heating water were concerned, these had stood the test of time, and were acknowledged to be perfectly reliable. Dealing with the question of the requirements for hot-water supply in an ordinary house, Dr. Herzfeld had stated that the average consumption would be 80 gallons at a temperature of 140° Fahr. This was a low estimate, particularly in view of the bath requirements that usually occurred. But, assuming it to be correct, he would like to state what could be done by means of a gas-heated apparatus, by way of comparison with the centrally-heated plant put forward in the paper. To meet these requirements by a properly constructed gas-heated apparatus would necessitate the use of only 160 cubic feet of gas, assuming that it was heated and used right off; while a suitably covered apparatus with thermostatic control, reducing the gas supply, at such times as there was no cold water contained in the apparatus, to about 4 to 6 cubic feet per hour, would enable a supply of hot water to be held available throughout the day with a total consumption of about 260 cubic feet of gas. The price of good coal was mentioned at 16s. per ton, At this price it could not be suitable for the purpose, as it must be of a very low grade; and in considering the running cost, the coal item would probably need to be readjusted. Passing to the question of capital expenditure, &c., he did not see any provision made for the insulation of the boiler, storage, and circulating mains, which, being underground, would require treatment in an efficient manner, failing which the heat losses could only be maintained at an extravagant fuel bill. It would further be necessary to provide a proper system of channels or tunnelling, to allow of the mains being laid without binding, in order that free expansion and contraction would be possible. Generally speaking, therefore, this item needed considerable readjustment; and it would possibly be found that in making an efficient system, an increase of upwards of 100 per cent. would be necessary, as the items mentioned were of an expensive nature. Taking these figures into consideration, and the greater possibilities that existed in regard to wastage by individual householders, it certainly pointed to the gas-heated system being the more economical form of apparatus to adopt.

Mr. Edwin T. Hall agreed with Mr. Searles-Wood that if any installation went through the public way the promoters would have to get an Act of Parliament. As to the practicability of supplying hot water, there could be no doubt, as in some of the large public institutions he had erected he had as great a length as 16 miles of hot-water pipes supplying the different buildings.

Mr. F. W. Goodenough alluded to the average daily consumption of electricity for cooking, which had been placed by Dr. Herzfeld at less than half a unit per head. This appeared to him to be a low figure, even assuming that all the hot water required for cooking as well as washing-up was provided from another source. At 2½d. per unit (assuming a household of eight), the cost would be 9d. per day for cooking, *plus* the cost of hot water, against not more than 3d. for all the cooking and hot water required for a household of the same size, using gas at 2s. 6d. per 1000 cubic feet. Judging from experience, the allowance of £26 per annum for stand-by was very much too small, as he knew of cases where the electricity supply company charged £4 per kilowatt of maximum demand per annum, which would amount, in the case cited by Dr. Herzfeld, to £224, instead of only £26. The estimate also did not appear to include anything for water, management, local expenses, or bad debts. It was not obvious as to what means would be adopted to limit the consumption of hot water, which would be very freely used indeed if it were supplied at so much per house per annum, in the same unrestricted way as cold water. He was of opinion that an ample hot-water supply could be obtained for a house of the size contemplated, by means of independent coke-boilers in the house, for a less sum than the £9 per annum quoted; for friends of his who had adopted coke-boilers for their hot-water supply found that the cost for a large household did not exceed 3s. per week, including a supply of hot water to radiators, as well as for all other purposes. Moreover, hot water supplied by gas would not prove more expensive in many households than the £9 per annum stated by Dr. Herzfeld.

Mr. A. S. E. Ackermann suggested, as an alternative method of obtaining the same result as that desired by Dr. Herzfeld, the use of gas-engines driving dynamos. The engines could, he said, be supplied with producer gas, which could also be utilized for cooking and warming; while the cooling water which had to be circulated through the jacket of the cylinder of the gas-engine could be employed for the hot-water supply, and also for warming if required. The electricity could be used for light, heat, or cooking, according to the circumstances and the fancy of the people interested. He noticed that in no instance were the contingencies set down at more than 5 per cent.; while in several cases they were only 3 per cent. He considered that these amounts were altogether inadequate; and that at least 10 per cent. should be allowed.

Mr. Justus Eck said one speaker mentioned that for the quantity of hot water proposed to be supplied, a local consumption of 260 cubic feet of gas per day would suffice. Basing the cost upon the gas company's domestic rate of 2s. 6d. per 1000 cubic feet, it would be seen that the cost of hot water thus produced would reach £11 7s. in place of £9, and there would not be the facility of obtaining extra-large quantities for sudden demands when they arose. Particular stress must be laid upon the great convenience and saving that would accrue in several directions. The reduction in the amount involved for domestic service was also important.

Mr. E. P. Hollis (London) was sure Dr. Herzfeld was ventilating a question that would need very careful consideration in the future; and, whatever one might think of the technical features of the scheme, its ambitions were commendable to the great body of people.

Mr. F. Husband agreed with Dr. Herzfeld as to the importance of making use of electricity to do all work, from a domestic point of view, in heating, cooking, and hot-water supply, provided it could be furnished at a minimum rate that would compare favourably with the cost of the older and more conventional methods. The whole question lay in the fact that, given electric energy at a sufficiently low figure—say, 1d. per unit—from a supply company or corporation, electrical heating appliances ought to be installed universally; and then the still prevailing theory of electrical energy being expensive would become a myth.

Dr. Herzfeld, in reply, said his scheme carefully avoided the crossing of public roads by pipes or cables. As to the cost of heating water by gas, both Mr. Potterton and Mr. Eck had only taken into consideration the actual cost of fuel, and not all the other charges—attendance, repairs, depreciation, &c.; and, further, though 80 gallons of hot water was a fair daily average for the class of house in view, he had actually provided for about 130 gallons. The price of coal—16s. per ton—had been criticized. He knew of large consumers in London who could obtain a good coal at this price. The cost of insulating the hot-water installation had been included in his estimates.

RUST PREVENTION.

By Dr. R. NÜBLING, of Stuttgart.

Dr. R. Nübling in an article in a recent number of the "Journal für Gasbeleuchtung," points out the importance of using protecting paints for constructional ironwork on gas-works, especially for the sheets of gasholder bells, which are alternately exposed to the air and to water which contains various chemical impurities. He observes that many attempts have of late been made to investigate in a practical and scientific manner the causes and prevention of rusting of iron.

In regard to the cause of rust, the old theory that carbonic acid was essential to the first stage of the rusting process has been disproved by rust having been produced in the absence of carbonic acid. Recent investigations point to rusting being purely an electrolytic process. The disposition of the iron to pass into solution in water implies that iron sends ions charged with positive electricity into a solution which is dissociated electrolytically, and therefore contains hydrogen ions positively charged alongside hydroxyl ions negatively charged. The result is that the hydrogen ions are oxidized by the oxygen present in the air or in the solution and are thereby separated, and the iron ions pass into the solution, becoming converted into iron hydroxide, and thence into insoluble rust. The process is hastened by the presence of carbonic acid, which is always found in the atmosphere. Theoretically iron is spoken of; but the iron used technically is a mixture of very many chemical elements, among which manganese and carbon are of special importance from the electrolytic point of view. Owing to their presence, the surface of a piece of iron consists of a large number of galvanic elements alongside one another. The surface is more or less strongly or rapidly attacked according to the number and distribution of these foreign bodies; and the painting or coating of iron has for its object the prevention of this attack. The author proceeds to consider, from the standpoint of the prevention of rusting, the nature and properties of different paints and rust-preventing compositions.

He remarks that a number of requirements must be fulfilled by a rust-preventing paint. It must have good covering power, which means that the coating must be impervious and opaque. It must spread freely, so as to give rapidly a smooth coating, and a given quantity must cover as large an area as possible. It must not require too long (say not more than 12 to 18 hours) to set and dry. It must have a certain elasticity or binding property after drying, and when dry must not show cracks, ridges, or pores. Various methods and forms of apparatus have been devised for testing these qualities. Cheap paints are, as a rule, of little value because their cheapness is due to worthless admixtures, such as loading by barium sulphate, or employing cheap oils and petroleum distillates as vehicles. Given, however, good paint, its efficiency is affected by a number of influences. In the first place, all loose particles must be removed from the surface to be painted, and the surface must be dry.

Tar paints and oil or varnish paints are mainly used for painting ironwork. In regard to the first, the solvent or vehicle used must be suitable, so that the paint does not dry too rapidly and become brittle; while in particular the solvent must be free from chemical constituents which would directly act on the iron. Drying takes place through volatilization of the greater part of the solvent. The coating becomes dull in course of time, as the less volatile portion of the solvent volatilizes, and incipient destruction of it sets in. Even without the blistering or breathing of the paint, the chemical changes effected by the influence of weather, and the porosity provide causes which sooner or later lead to the destruction of the coating. With oil paints, on the other hand, the body is mostly of a metallic or mineral character, and is mixed with boiled linseed oil or varnish containing it. Substitutes for linseed oil affect the goodness of the paint. The hardening of oil colours does not complete the chemical change, since oxidation to linoxyn proceeds for a long period and, in conjunction with influences of weather and porosity, leads to the ultimate destruction of the coating. The porosity appears to be due to the drying or contraction of the base of the paint, and not, as in the case of tar paints, to volatilization of the solvent or vehicle. Other points to be regarded with reference to oil paints are the saponification of the linseed oil by certain pigments which produces a difficultly soluble compound, and the electrical behaviour of the pigment towards iron. Particles of the pigment may form galvanic elements with the iron—the latter acting, according to their nature, either as cathodes or as anodes.

The considerations adduced by the author lead him to the conclusion that the first requisite in a paint for ironwork is that the pigment of the paint should be a material which is electro-positive to iron. In regard to galvanized and tinned surfaces, zinc is positive and tin negative to iron; and in oil colours manganese and zinc compounds are good because they are positive to iron. But with such pigments the porosity also is of importance. A vehicle which is readily volatile, and spreads easily, so that it rapidly distributes itself into the pores, is of service for leaving in the pores the material originally dissolved in the vehicle. But a thin coating applied by means of such a readily volatile vehicle does not afford a lasting protection of the ironwork. It should not dissolve dried oil and tar colours, and its purpose should be rather to fill the pores of a primary coating of oil or lead paint. Such a volatile paint also is useful for coating metal work which has been cleaned from loose particles of old paint, in that it serves to prevent the extension of incipient rusting. If oil or tar paint is then applied and expense is not objected to, the best procedure is to apply a final coat of the volatile paint.

In conclusion, the author says that the usual tar and oil paints with good solvents or vehicles must be judged according to the chemical and electro-chemical behaviour of their solid constituents towards iron. Such a paint ensures partial protection against rust, but by itself is not a guarantee of complete protection. For further security against rusting, a solution which will fill the injurious pores must be applied, so that the paint is protected from the influences of oxidation, &c. Though the rust protection thus secured is not perfect, it is very nearly so. Further investigations are needed. In certain cases, the effects of chemical agencies on the paints have to be considered; but they are generally of subsidiary importance.

LIGHTING AND EXTINGUISHING STREET-LAMPS BY HERTZIAN WAVES.

Among the labour-saving methods introduced during the past few years in connection with the manufacture and distribution of gas, the automatic lighting and extinction of public lamps may be regarded as being by no means the least important. Indeed, it has made such progress of late as to justify it being considered as an essential feature of the equipment of an up-to-date distributing system. Up to the present, two methods have been at the disposal of gas engineers—one in which clockwork is employed, and the other in which the pressure in the main is relied upon to start and extinguish the light. It has been proposed, however, to introduce a third, in which one of the latest marvels of scientific advancement—viz., Hertzian waves, or vibrated currents—is to be utilized to open or close a gas-pipe from any distance at a given time; current being passed to a detector actuated from a wave-transmitting station. The proposal is the subject of a patent taken out for France by the Paris firm of MM. C. & G. Grimmeisen; and the following particulars have been obtained from the specification.

The mechanism employed produces the following results: (1) Turning on the gas at the main; (2) production of an electric spark or the incandescence of a suitable substance to ignite the gas; (3) cutting off the gas from the burner. It is stated that in carrying out the idea, the appliances now in use can be utilized. For example, automatic ignition from a distance may be obtained by the aid of apparatus in each lantern consisting essentially of (1) a receiving antenna for the waves transmitted from the central station; (2) a wave detector of a suitable type—magnetic, thermic, or thermo-electric; and (3) a relay operated by the wave detector, and fixed on the gas-pipe so as to produce the necessary currents to turn on the gas by moving a valve or other closing device, and simultaneously cause ignition by an electric spark, by the incandescence of a suitable substance, or by a pilot light when possible. The lantern, furnished with the antenna for the reception of the waves from the central station, would be provided with a suitable source of electricity, consisting, for example, of two dry accumulators, of such capacity as to ensure action during a long period without being re-charged. This is the more easy as these accumulators would only have to work for a few seconds daily.

The new idea must be applied so that transmission of the currents will not be liable to disturbances from any cause—for example, atmospheric electricity; and regularity of transmission can be assured by mechanical or electric devices. With regard to the former, it is easy to arrange mechanism (clockwork, for instance) so that the apparatus will be acted upon only by a series of signals transmitted at precise intervals; and as atmospheric disturbances have not this frequency, they cannot cause any movement. As to electricity, from the point of view of preventing disturbances, it is well known that some detectors are only sensitive to waves of a certain frequency—*i.e.*, having an accurately known order of vibrations. Consequently, it will be sufficient to select this order of vibrations so that it will not be affected by outside influences.

Jacketing a Steel Water-Tank with Concrete.—The process of jacketing a steel water-tank was described in the annual report of Mr. F. J. Fischer, the Chief Mechanical Engineer of the Los Angeles (Cal.) Water Department. For some time the Edendale section has been supplied from a large steel tank having a capacity of 528,000 gallons. While this tank was originally built with a liberal factor of safety, recent unexplained failures of tanks of similar construction led the department to determine to be doubly safe. With this in mind, the capacity of the tank was increased to 593,000 gallons by adding 5 feet to the height; and the steel shell was then encased in reinforced concrete having a thickness of 5 inches on the inside and 10 inches on the outside—the reinforced concrete walls of themselves being of sufficient strength to withstand the hydraulic pressure with an ample factor of safety. This improvement, Mr. Fischer points out, has meant the replacement of an unsightly black steel tank with a concrete structure simple yet commanding in appearance.

WAVERLEY ASSOCIATION OF GAS MANAGERS.

Annual Meeting in Edinburgh, June 7.

Address by J. W. NAPIER, Engineer of the Gas and Electricity Departments of the Alloa Corporation.

It is always a subject of surpassing interest to the student who watches the evolution of things to pencil in his log-book the changes that take place in the profession of his life's calling. Looking backwards, he perceives the order of things mounting step upon step towards improvement and higher ideal. Murdoch, in his rude cave by Bello Water, near the village of Lugar, his birthplace in Ayrshire, is said to have burnt the splint coal found on the top of the black band ironstone; and Samuel Smiles, the eminent Boswell of hidden genius, states that "he may there have derived from his experiments the first idea of gas as an illuminant." The years as they come provide a fresh order of things; the theories of the past as to what is best have been realized, and the apparent perfection of processes finds a place in recognized practice. Herein lies the disappointment. There is no perfection in the arts and sciences; and on the last milestone as we know it along the great highway of industrial progress the word "Finis" dare not be chiselled. Each one of us may be likened unto the builder, putting stone upon stone, with here and there a cornice; but no one can reach high enough to rest the final copestone.

The calling of the gas manager of to-day is a profession, and not a trade. It is matter of congratulation that the technical and scientific trained man is the one now sought after by company and corporation to fill positions, not alone in high places, but also, it can be said without doubt, in the smallest gas-works. This, in my belief, is the happiest and most valuable assurance obtainable wherewith to guarantee a stable position for the gas industry in its long future. Technical colleges, correspondence classes, and a weekly Press ever flowing with its record of new thought and latest practice, absolutely prevent anyone from going unprovided for. It is not for me to remind you that mere accumulation of knowledge, while to the mind it is like what blossom is to the tree, is not enough, and that practical result is the service expected of us.

The Waverley Association—what a world of romance, of ballad, and story the word "Waverley" suggests, as we link it with the name of the Great Unknown!—with its long travel of years behind it, reaching back to the beginning of Gas Associations, has a record of consistent, though modest, value; and I count it no small honour that I should have been asked to be a contributor to its proceedings.

SOME OBSERVATIONS ON DISTRIBUTION.

Having regard to the changed conditions of gas supply, a reference to distribution may appeal to the members as of immediate interest. I have frequently been struck with the complaint heard from time to time that, owing to small mains, the gas manager is hampered in not being able to give sufficient pressure at the consumers' premises.

The members of the Association are doubtless familiar in their own towns with the number and considerable length of 2-inch and 1½-inch pipes that do duty for mains. The expenditure required to lay larger pipes may not commend itself to the directors of the company, and so the old order of things is maintained. Weighting the gasholder is helpful to only a small degree, and is seldom, if ever, sufficient. While I mentioned the laying of larger mains as the solution, I venture to assert that the situation can be met by a less expensive system. I refer, of course, to boosting-up the supply of the whole town from the works. It is particularly interesting to note that the extra pressure wanted is usually not more than from 2 to 3 inches.

The question before us, therefore, is whether for such a small increase of pressure it is economically better to carry out a wholesale enlarging of main-pipes at great cost, or the installing of a simple booster at the gas-works at only slight expense, and having at command a means of increasing pressure far in excess of any likely requirements. These pipes are practically in good condition; the only fault probably being that the depth at which they are laid is too shallow. The circumstances—to take a typical case—appear, therefore, to be that, the mains being too small, and the holder unable to give the necessary initial pressure, it is desired to afford increased pressure during lighting hours only. In this regard, it is usually found that sufficient pressure can be given for day supply. For the lighting load, I would advocate a pressure in the area of supply of 3½ inches; and it will be found that consumers appreciate the increased light obtainable. I am aware that to many managers this pressure is unnecessarily high; but observation and experience enable me to say that the result warrants the practice.

Gas-works, however small, that are able to find use for an exhauster, have the means already at hand whereby a rotary compressor can be fixed, with valves and suitable self-acting positive bye-pass valve and connected at the holder outlet-pipe. The compressor would be belt-driven from a countershaft run off the engine driving the exhauster, or else a separate engine could be installed to drive either compressor or exhauster, and would act as a stand-by for either. The very excellent arrangement at the Dalkeith Gas-Works* is to be commended, and well worth the attention of members considering any similar scheme. The first cost for plant is small, and the ease and economy with which it can be run are very striking. There are instances of large mansion houses, situated at probably one to three miles distance, being supplied from too small a pipe. The author some time ago successfully installed one of Keith's small compressors at the outlet of the meter at the house, driven by a hot-air motor, and instead of 1 inch pressure, as formerly, a pressure of 3 to 4 inches was easily obtainable, and a long-standing grievance removed. There must be many such examples within the knowledge of members; and doubtless means similar to that described have been adopted.

There is a prevalent complaint on the part of gas managers that fittings in the older class of property are the cause of inefficient supply at the burner. I would ask the members, while admitting the truth as to fittings being inadequate, whether the difficulty would not be best overcome by the method here outlined; bearing in mind what I desire to emphasize—viz., that an addition of only 2 to 3 inches pressure is wanted at the works during lighting hours only, and how extraordinarily simply this can be obtained.

COAL STOCKS AND PRICES.

The recent coal strike has given rise to considerable discussion anent gas-works stock of coal. We are prone to the affliction of being panic-stricken; and advocates have appeared stating, with a relish of satisfied safety, that nothing short of a stock equal to three to four months of the maximum period of consumption is required. In my opinion, this is caution exercised to excess. The money value of such a quantity of coal in stock is considerable; and depreciation of its quality adds a direct loss. A calm consideration of the whole matter will confirm the judgment that has all along obtained—that a six weeks' stock of the maximum period of requirement is all that is needed.

What is of more immediate interest is the increased price of coal for the current year's contracts. Whatever be the causes of the increase, commercial or political (the latter cause is undoubted, and is the outcome of overflowing zeal to do good, when harm to individual and nation alike is the result), it will be our duty to give close attention to the nature of our purchases. Fortunately, the gas industry—like its sister the shale oil industry—is at the present moment happily placed with an increased market value for its products of coke, tar, and sulphate of ammonia. The increased revenue from this source, while not meeting the enhanced cost of coal, will not render necessary any general increase in the price of gas; and where the price will require to be raised, only a slight increase will be necessary.

VALUATION OF COALS.—THE WATER-CONTENT.

In the matter of the valuation of coals, I would plead for more attention being given to the buying of coals on the basis of the value of residuals. I desire, in the first place, to refer briefly to the water-content of coal. It is well known that coals from different pits vary in the percentage amount of what might be termed natural water. For example, if we take the average amount of water present in coals at 6 per cent., this is equal to 13·44 gallons, or 134·4 lbs., of water per ton of coal. A coal with 12 per cent. of water would contain 269 lbs. of water per ton, and, compared with the standard of 134 lbs., would show an excess of 135 lbs. of water. At 12s. per ton purchase price, the *plus* quantity of water is costing fully 8d. per ton; and this extra charge for mere water is appreciable.

PRODUCTION AND QUALITY OF COKE.

Coke is justly looked upon as the most valuable of all our residuals. With a selling value of 10s. per ton for coke, a difference in yield of 1 to 2 cwt. of saleable coke between different coals makes an appreciable difference in the revenue account. The amount of coke produced from coal can be easily determined, even in the smallest works. It only requires a weighed quantity of coal to be carbonized in the retort, and the coke produced weighed. In the analysis of a number of coals that have passed under my examination from time to time, in ascertaining the coke produced per ton of coal, I have been struck with the difference between what I might be allowed to term the "analysis" value and the "saleable" value of the coke produced—and more particularly from nuts and so-called coking dross.

For example, one material, which on analysis showed a yield of 13·1 cwt. of coke, having carbon 96·65 per cent. and ash only 3·35 per cent., would be taken as of excellent value. On putting the material through a trial test in the retort, and examining the coke produced, the following results were obtained:—

Saleable coke per ton of coke produced . . .	12¾ cwt.
Breeze " " " . . .	7¼ cwt.

Percentage of breeze = 56.

* See "JOURNAL," Vol. CXIV., p. 743.

This is a very extreme case; but the example is valuable as showing the need for ascertaining the absolute market value of the coke.

Another example is: Coke per ton of coal, 12·5 cwt.; carbon in coke, 88·71 per cent.; ash, 11·29 per cent. On further examination to ascertain the saleable amount of coke, the following was the result:—

Saleable coke per ton of coke made	16·32 cwt.
Breeze " " " "	3·68 cwt.

Percentage of breeze = 18·4.

The third example is: Coke per ton of coal, 12·7 cwt.; carbon in coke, 91·4 per cent.; ash, 8·6 per cent. Examination for value of saleable coke resulted as follows:—

Saleable coke per ton of coke made	19 cwt.
Breeze " " " "	1 cwt.

Percentage of breeze = 5.

The breeze was determined by the amount passing through a ¾-inch mesh riddle.

Again, we at once observe that a material for gas-making purposes, while yielding a satisfactory weight of coke, on submitting the latter to a critical examination will determine a very serious loss to the purchaser. With coke selling at 12s. per ton and breeze at 2s., or a difference in value of 10s., each hundredweight of breeze produced is equivalent to a loss of 6d. per ton of coke, one coke compared with another. It can easily be seen, therefore, how a difference in value of 1s. to 2s. per ton of coal may be brought about from this source alone. I have not referred to the presence of an excess amount of breeze being unsuitable for the working of producers; but this will undoubtedly be the case.

In carrying out the tests referred to, the physical character of the coke was noted as of importance; some of the cokes produced being soft and easily broken. Incidental to the amount of breeze produced in gas-works where coke-handling appliances are at work, the physical character of the coke is all important, as upon this will depend the amount of breeze produced; and I have endeavoured to show that great loss may accrue in this direction, to which I venture to think that sufficient attention has not been devoted. The amount of saleable coke per ton of coal is of vital importance at the present time, not only because of the higher price to be paid for coal, but also from the fact that coke may be expected to yield an extra value of about 3s. per ton.

VERTICAL RETORT COKE.

Before departing from the subject of coke, it may be of interest to compare coke made in vertical retorts with what is known as malting coke, which realizes a high price. The vertical retort coke was produced from the coal ordinarily used at the Alloa Gas-Works, and is a sample from a trial test in the experimental vertical setting at the Temple Gas-Works, Glasgow.

	Vertical Retort Coke. Per Cent.		Malting Coke. Per Cent.
Carbon	89·20	..	91·25
Volatile matters	1·05	..	0·80
Water	0·35	..	0·15
Ash	9·40	..	7·80
	100·00	..	100·00

The sample of malting coke was made from the well-known Bannockburn coal.

Malting coke is at present selling at fully 20s. per ton; and vertical retort coke of almost the same quality (as the above analyses show) should command a high price. This advantage of vertical retort carbonization is best seen when we compare the price of coke produced from that system with coke made in horizontal retorts, selling at only 12s. per ton. I venture to say that the vertical retort will enhance very highly the value of coke, at least in the particular market referred to.

OTHER RESIDUALS.

I need make only short reference to tar. This residual is at present realizing a high price, having increased from 11s. to 17s. per 100 gallons during the last twelve months. The latter price is equal to 2d. per gallon; and the difference in value between coals of high and low yield of tar can at once be appraised.

Sulphate of ammonia is also yielding a high price, which, if maintained, will contribute very materially to the revenue from residuals. In this matter, we need only remind ourselves that heavy charges in the retort conduce to higher ammonia yield. It is well known that coals from one of the coal-fields in Scotland are poor, yielding not more than 20 lbs. of sulphate of ammonia per ton, and coals from another well-known area yield about 30 lbs. Deducting the cost of production, each pound of sulphate of ammonia has a value at the present selling price of a little over 1d.

I have dwelt upon the subject of residuals, being fully satisfied that it is to this source we must look for a means of recouping the extra cost of coal we are now asked to meet. It is knowledge to many of us that in some gas-works the residuals are considered of more importance from one point of view than the gas itself. This is clearly evidenced when reviewing the analysis of works costs, and the price of the raw material is more than fully met by the return from residuals.

SCRUBBING.

Short reference may at this point be made to the necessity of efficient scrubbing of the gas. The tower-scrubber, in my opinion, is extinct as an up-to-date ammonia absorbing plant. The brush-scrubber, with its separate compartments, furnishes a means of treating the gas with strong liquor—thus providing an atmosphere of ammonia to absorb the carbon dioxide and sulphuretted hydrogen, thereby relieving the purifiers, and, lastly, ensuring the gas being washed with clean water.

The practice of cleaning brush-scrubbers with a solution of soft soap is to be commended, as helpful in reducing naphthalene, and also for the cleaning of the brushes, in which respect it is better than steaming. It has been found, after so treating the brushes, that the loss of ammonia was reduced from 2 grains to 0·4 grain per 100 cubic feet of gas.

TEMPERATURE CONDITIONS AND LEAKAGE ACCOUNT.

While the influence of temperature on the measurement of gas at the station-meter is quite well known, its effect in determining the actual leakage is not so generally taken into account in gas-works as it ought to be. Pertinent to this question, it may be noted that oxide of iron purification carried out under conditions of temperature necessary to efficient working of the material in the purifiers has had an influence on the leakage account which may have passed unobserved.

The author was led to discover this influence when his leakage account for the year had increased about 3 per cent., and no satisfactory explanation at the time could be given. It had not been customary at that particular period to correct for temperature. It will be recollected that, with lime purification, temperature conditions, while necessary to satisfactory working, were not so closely scrutinized. With the use of oxide, however, we have all realized that a temperature appreciably below 60° Fahr. means less activity of the material, and that a temperature of 65° to 70° Fahr. is common; the extra heat being obtained by the admission of live steam into the gas, or, what is preferable, by steam-pipes laid on the floor of the purifier.

It would thus appear that, with changed working conditions as between lime and oxide, the temperature of the gas at the station-meter has been higher than was formerly obtained, with the result that the volume of gas measured is inflated. This difference of temperature may amount to from 10° to 15° Fahr. It may be noted that a difference of 10° Fahr. is equal to 2⅓ per cent. in unaccounted-for gas; and, incidental to this matter, the make of gas will have nominally increased by a like percentage, or some 250 cubic feet per ton of coal on a 10,000 cubic feet basis. The cause of the increased leakage account as experienced by the author was thus simply explained; and the subject is now brought under notice in view of possible experiences in other works.

Returning for a moment to the correction of volume of gas indicated at the station-meter, daily observations of barometer and thermometer are noted; and managers of smaller works need experience no difficulty in making the correction. An elementary example may be excused. Suppose the make of gas per 24 hours is 50,000 cubic feet, the temperature of the gas 65° Fahr., and the reading of the barometer 29·2 in. On referring to the table of factors to be found in text-books, the multiplier is 0·960. Therefore, 50,000 × 0·960 gives 48,000 as the volume of gas corrected to standard conditions.

Following still further into the matter of the effect of temperature on measurement, we have next to consider the effect on the volume as measured through the consumers' meters. Some time ago, daily observations were taken of the temperature of the gas in the street-mains; and it may be useful if the following data be now put on record. The figures given are the maximum and minimum daily observations, also the average daily observations for each month of the year. The figures are also very interesting and very striking. They emphasize the necessity for accuracy in all our works.

	Max. Deg. Fahr.		Min. Deg. Fahr.		Average. Deg. Fahr.
January	40	..	35	..	37
February	44	..	36	..	39
March	43	..	37	..	39
April	46	..	39	..	44
May	59	..	47	..	50
June	65	..	54	..	59
July	68	..	56	..	61
August	65	..	54	..	59
September	58	..	51	..	54
October	59	..	45	..	50
November	49	..	38	..	44
December	44	..	36	..	39

If the above figures are looked into, it will be found that an average temperature of 47° Fahr. may be taken as the temperature at which the gas is measured at the consumers' meters during the year. It therefore follows that, in making up a note of the unaccounted-for gas, the difference in volume between the make of gas already corrected to 60° Fahr. and the volume of gas sent out from the works at 47° Fahr. should be ascertained. For example—

	Cubic Feet.	Cubic Feet.
Gas made		25,000,000
Gas sold	23,000,000	
Gas used in works	300,000	
25,000,000 cubic feet at 47° Fahr. corrected to 60° Fahr., difference in volume	800,000	
		24,100,000
Leakage		900,000 = 3·6 per cent.

My excuse for referring at some length to this phase of our

business is simply that accuracy should be sought after in all things; and it is seeming injustice to our own selves that hitherto we have paid every attention to weighing our tons of coal, while volume of gas has been allowed to "go as you please."

COMMERCIAL SECTIONS.

One other subject remains for me to make reference to. Attention has been directed to the value of residuals as all-important at this time when coal has increased in price. The value of the Commercial Sections of the North British Association may be urged upon the members of the Waverley Association. I know that you have pride of name, and honour in history, and that your wish is to keep single; but academic riches of this sort may well be laid aside when occasion demands. What are members of this Association doing in commercial matters as regards union and mutual help among themselves? It is true that, by reason of geographical position, a series of meetings of sufficient frequency would be both inconvenient and expensive. It may be suggested, however, that a simple system on the bureau principle, as a kind of central agency, with one official who would be the Secretary of the Association, would suffice. Information as to prices of bye-products, &c., could be obtained by correspondence from the other Commercial Sections, and distributed to the members. In an area such as that of the Waverley Association, there ought to be a community of business interest between the members, which, if it did nothing more, would prevent isolation.

In closing, permit me to wish for your Association a continuance of good work. Your environment is not amidst the noise and smoky breath of toiling industry, or so much in touch with the ebb and flow of commerce, but of an historical interest that sings of fair Melrose, by the pale moonlight and haunts of Tweed.

Discussion.

The CHAIRMAN, in opening the discussion, said it would do a lot of them good to go over the address slowly in private. He, at least, would make a point of doing so. Last year he had a word or two to say about a small compressor that had been fixed up at Coldstream at the outlet of a meter supplying a mansion. He was very pleased to be now able to state that the results anticipated had been fully realized. The mansion referred to had been a source of great complaint to his Company. They used so much gas that, although there was a 3-inch main, they never could get enough pressure. A small rotary compressor, driven by a 1½ H.P. gas-engine, was installed; and from the time it was set in motion they had never had a complaint. This was a thing that had been unknown formerly. Not only did they keep the customer, but they increased the gas bill 100,000 cubic feet each four months. So there was no doubt about a compressor paying.

Mr. R. W. COWIE (Dalkeith) said there were in the address quite a number of points which were not beyond even the smallest manager of the smallest works. At the beginning reference was made to the question of small mains. Mr. Napier truly remarked that this was common to most gas-works, especially those which had been laid down for a considerable number of years; and he very well illustrated how the difficulty which small mains caused could be overcome. In Dalkeith, they had a good number of small mains; but he had been much amused at some of the service-pipes which he had had to renew. He had taken out ¼-inch pipes for service-pipes—¼-inch malleable iron pipes. They would wonder how any gas could pass through them. It was the case, however, that he had had to take out ¼-inch and ⅜-inch and ½-inch pipes and put in ¾-inch ones. He would ask Mr. Napier what pressure a hot-air motor would work against. His reason for asking was that a question had been put to him by a gas manager who had no exhauster. He wanted to use oxide of iron for purification, and to introduce the usual small percentage of air. He had no means of putting air into the gas at the purifier, and he (Mr. Cowie) suggested a hot-air motor. On making inquiries, however, he was told that it would not work against the holder pressure of 3 inches. Now, Mr. Napier said a pressure of 3 to 4 inches. He would be very pleased to know if it was the case—if a hot-air motor could work against this pressure. A very interesting part of the address was where the author mentioned the valuation of coal and the water content. He would like to know if it was the case that the collieries allowed a little for the water in washed nuts. He had been told that they did; and on carefully weighing the coals at the works, he found that they did not always get the waggons to agree. Sometimes they got them a little heavy, at other times just the net weight, and other times a little below. He very much doubted whether they were allowed anything for the water in washed nuts. He had been interested to hear of the method of cleaning the brush scrubbers by soft soap. Mr. Napier also emphasized the advisability of making corrections for temperature at the station meter, so as to arrive at a proper leakage. He knew that Mr. Napier was very methodical; but then he had got someone to do a lot of his work. In smaller gas-works, where the manager was understood to do all the clerical work, it would entail a considerable amount of work to make the correction every day; and it could not be got continuously, unless the manager had a boy trained to make the corrections and take the readings in his absence. He would like to know if the Commercial Section of the North British Association would give information to the Waverley Association, were they to have a Commercial Section in connection with the Association. He understood that some years ago, when the other Commercial Sections were started, an attempt was made to launch one in the Waverley district, but difficulties cropped up. He did not know whether or not the suggestion which Mr. Napier threw out in his address was considered then. If it was not, he would be inclined to move later on that the Committee consider the suggestion, because they really could not be too well informed in regard to prices and the commercial side of their work. He would like if Mr. Napier would give them a little more information on the matter.

Mr. HENRY O'CONNOR (Edinburgh) remarked that Mr. Napier's paper was exactly the thing required by the Association. There were an immense number of points to be touched on and spoken about; and there was a sufficiency of technical matter to make it interesting to everybody. First of all, he would like to back-up Mr. Napier's suggestion with regard to the increase of pressure. There was no doubt that at the present time, with inverted burners, they required a much greater amount of pressure than in the past. They all remembered, in the old days, a suggestion—made, he thought, by Mr. Newbigging—to keep down the pressure in the district; and it was customary to consider that, if they could get ½-inch pressure at the farthest end of the district, the gas managers would be satisfied. But ½-inch pressure would be of very little use now. For inverted incandescent burners, 2 inches pressure was the lowest that could ever be allowed; and the arrangement of a boosting plant was excellent for obtaining this pressure in districts where the pipes were too small, or where there was a difference in the levels. As regarded the question which Mr. Cowie had put about the hot-air engine, he thought he could give some information upon this point. These hot-air engines were only made in very small sizes. He recently tried to get one for pumping a small quantity of water; and he found it was impossible to obtain it of sufficient size to be of any practical use. Of course, if the quantity of air to be put into the gas was only small, the pressure could easily be increased by means of gearing between the engine and the blower. Motor-engines were much in use for petrol-gas plant where the pressure was only ½-inch to 1 inch. They were made to drive both boosting blowers and reciprocating pumps, so as to force the air. Of course, if anything larger was required, a small gas-engine could be easily utilized. Mr. Napier had remarked that from six to eight weeks' supply of coal was sufficient. This had always been the figure taken so far as he could remember; and he had not seen any reason to alter his ideas on this point even during the recent coal strike. As regarded what had been said about coke, he commented on the very small size of the coke in Scotland as compared with what one was accustomed to in England. The breeze in the English coke was mostly used at the gas-works for stoking boilers, but the breeze from the coke in Scotland was not usually so good for this purpose—it was smaller and more powdery. Of course, with the vertical-retort coke, the weight of the carbonized coal resting on the coke below was always compressing it and making it much more dense and hard. Referring to the use of coke for malting purposes, he said he was induced to go into this matter very considerably; and he evolved with Dr. Drinkwater an arrangement for removing the arsenic from the coke. The first tests of the invention were made by Mr. Brown, who was then at the Lasswade Gas-Works; and it was so efficient that Dr. Miller, of Manchester, said it was arsenic-free. It was used at a number of works in England. Until the scare, some twenty years ago, ordinary gas-works coke was used for malting all over the country. With reference to the scrubbers, he was still a very great believer in the tower scrubber, provided it was high enough, and that a good distribution of the liquor or water was provided. He thought that where the tower scrubber had been found ineffective was in most cases where the distribution of water or liquor in the tower had not been sufficiently good. If this was put right, he was sure the tower scrubber would be not so far behind its more modern brother, the brush scrubber, which required power day and night to keep it moving. In regard to the effect of temperature upon leakage, this was an exceedingly interesting question. He would like to inquire whether Mr. Napier had calculated the difference month by month for the year, as well as by taking the average temperature. As to the Commercial Sections, he considered that every possible chance should be taken by their Association and by every other Association to keep in touch with one another. He had this brought to his notice in connection with the gas company with which he was associated. On making inquiries round about during the coal strike, he found that the prices varied to a very large extent.

Mr. SCOTT (Cowdenbeath) said he did not believe that anybody knew better than the manager of a small works of the difficulties that had to be contended with on account of small main pipes. He happened to have a small job on just now re-piping a district where the ordinary run of the pipes had been 1¼ inches for mains, with ¾-inch connections. He proposed to lift at least a mile of this throughout the town. They must remember that these pipes were laid about 1836; so that they could not be doing the Company very much good now. It was absolutely impossible to give people a supply of gas with their pipes in the condition they were. The case was one where a compressor was really of no service. There was no question, however, that where the only fault of the pipes was the size, a compressor was the system to adopt to overcome any difficulty in the pressure. While he did not care to go in excess of a 3-inch pipe, he would really do his best to keep it 2 inches and upwards. He thought that coal would increase in price, and he urged that the aim of gas managers should be to make the prices got for residual products pay as much as

possible of the extra coal cost. He hoped that, as a consequence of the coal strike, very few works would require to raise the price of gas. The prospect of so few doing this said a great deal for the condition of the gas industry. He emphasized the part that local conditions played in the price of coke, and commended the suggestion of paying attention to the leakage in relation to the temperature. He thought it would be advisable for everybody to attend to this, though he himself did not do it. [Laughter.] He also cordially commended the proposal in regard to the Commercial Sections.

Mr. EASSON (Jedburgh) asked what Mr. Napier would do where the leakage was only 4 per cent. If he started for temperature and pressure, he thought he would land on the other side. In small works, it was difficult for a manager to attend to all these things himself.

Mr. DANIEL MACFIE (Edinburgh) said that Mr. Napier in his observations on distribution got over the difficulty a little too easily, by saying "simply put on your booster and you are all right." He rather thought that the condition of the mains in Scotland was such that the booster would not be of much use, and that it would be better to remove these small mains, which were put in when they were supplying 30-candle power gas. Even if they had a booster, it seemed to him that the irregularities in a district would remain. Until they gave equal pressure throughout the day and the night, the consumer might say he was not being so well served as he should be. He quite agreed with Mr. Napier in saying that the Association should be connected with the Commercial Sections.

Mr. WADDELL (Dunfermline) said it was a difficult thing to get uniform pressure in any town. It was also very difficult to have uniformity of capacity of piping to secure equality of pressure. It was a question whether, in time to come, and in certain circumstances, it would not be well to give a higher pressure transmission and a higher pressure supply.

Mr. BLAIR (Haddington) and Mr. M'MILLAN (Lasswade) also briefly commented on the subjects referred to in the President's address.

Mr. NAPIER, in the course of his reply to the discussion, remarked that the outstanding result of the meeting, if the Committee went to work in the proper way, would have the effect of interesting the members in the commercial affairs of their profession. He was quite certain that if the Committee approached the two Commercial Associations of Scotland, they would be afforded not only a welcome but also a considerable amount of help. He put it to Mr. O'Connor that a tower scrubber, in so far as the passage of water was concerned, was always of the one strength, and did not permit of there being carried out the first essentials of purification. They must remember that purification began at a much earlier stage than when the gas came into contact with the oxide of iron. He would suggest to no one to work a tower scrubber—even with the opportunity of getting a second-hand one at a low price. With regard to Mr. O'Connor's patent process of taking the arsenic from the coke, he would like to ask whether it could be conducted successfully, and whether breweries had returned to the use of gas coke so treated. It would be a matter of great interest to him to work out the effect of the temperature during each of the months of the year and ascertain whether the result under each was greater than the result by taking the average figure. He emphasized the importance of paying attention to the residual products.

Mr. O'CONNOR mentioned that there were two ways of overcoming the difficulty with regard to the tower scrubber. One was to have two tower scrubbers, in one of which they put water and in the other liquor of a certain strength. Another plan was to put in clean water at the top and have weak liquor half way up the scrubber, so that by the time the two got to the bottom they were of sufficient strength to take out the carbon dioxide and the sulphuretted hydrogen. He stated that at Wakefield there were fifteen to twenty maltsters who used the coke which had been freed from arsenic, and it had been employed for four or five years now. The quantity of coke they used was increasing. In another town the same process had been adopted for hop drying; and he could assure Mr. Napier that where they were using the patent they were quite satisfied that the coke was being freed from arsenic.

Mr. WADDELL controverted Mr. O'Connor regarding the tower scrubber, which was all right in theory, he said, but there was difficulty in carrying out in a small works the ideas suggested.

The will of the late Mr. Joseph Timmins, of Wigan, whose death was recorded in the "JOURNAL" for the 14th ult., has been proved. He left estate of the value of £1807.

In the last number of the "JOURNAL" members of the gas profession attending the annual meeting of the Institution of Gas Engineers this week were invited to inspect a large and varied collection of new gas-testing instruments at the establishment of Messrs. Alexander Wright and Co., Limited, in Westminster. A similar invitation has been issued by the Welsbach Light Company, Limited, whose head offices are at the King's Cross end of the Gray's Inn Road, where they will be able to inspect the Company's "Pharos" high-pressure air and gas systems, and their latest designs in high-power low-pressure indoor and outdoor gas-lamps and other novelties for the forthcoming season. A visit should prove interesting to all who accept these invitations.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents*]

Coal Strikes and Strike Clauses.

SIR,—My Company had a contract with a colliery for the supply of a stipulated quantity of gas coal, to be delivered as required during the year ending at Midsummer next.

Deliveries were, of course, suspended during the period of the coal strike; and the colliery owners now claim to deduct from the stipulated quantity of coal that they were bound to deliver (in respect of the six weeks during which the coal strike lasted) a proportion equal to six fifty-seconds of such stipulated quantity, and to charge an increased price of 2s. per ton for the quantity which they claim to deduct and which is necessary to carry us on to Midsummer.

The letter containing the quotation for the coal was headed: "All quotations subject to strike and accident clause." But no information as to the conditions of the clause were given; and I have failed to obtain the same now upon application, but have simply received the autocratic statement that "our rendering of the strike clause must be accepted."

As this question must be of general interest to all gas companies, I should be much obliged if you would insert in next week's "JOURNAL" a short paragraph giving your views upon the matter.

GEORGE P. BROWN, Secretary.

Ringwood, June 6, 1912.

[This letter is referred to in an article on p. 716 on "Strike Clauses in Contracts."—ED. J.G.L.]

Alliance and Dublin Gas Company.

SIR,—I am gratified to notice that my letter in a recent issue has roused some interest in the question of this Company's position.

It appears to me that the time has arrived for patient British stockholders to take combined action; and with this in view, I suggest that all those who are interested should arrange a meeting in London, or one of the prominent provincial cities, so that it could be discussed as to what action would be most effective to bring the Company out of the rut.

There is no denying the fact that there is something radically wrong with the Company; otherwise the Stock Exchange would never mark down 5 per cent. sliding-scale stock at 72, instead of which it ought to be at 105 to 110. Let stockholders remember that, not only are their stocks depreciated by quite 33 per cent., but the 5 per cent. dividend ought to be substantially increased by the provision of the Company's sliding-scale.

The question of internal disagreement is one for the Directors to deal with sharply and firmly, if such a thing exists. The stockholders look to the Directors; and unless some immediate public explanation is forthcoming, signed by the Chairman, I shall pursue the question until some definite and satisfactory solution is found for this bad state of the Company's position on the Stock Exchange.

There appears no doubt that a substantial reason exists for an exhaustive investigation into the affairs of the Company; and stockholders would do well to press for it.

To judge fairly how very little appears to have been attempted in the past, one must go through the returns for a period of years, and compare them with other companies.

At one time the Gaslight and Coke Company was criticized; but in recent years, with enlightened and up-to-date management, this has been quite unnecessary, as things have been much improved. To-day, the Company may justly claim to be one of our pioneer gas undertakings. It is in the front rank of all progressive movements; and its projects are founded on sound lines, coupled with zealous and enterprising efforts of a splendid staff. One of the principal bugbears of this Company was its relatively high capital, which nearly two decades ago [1894] stood at 13s. 4d. per 1000 cubic feet of gas sold, whereas in 1911, it exhibited a magnificent reduction to 11s. 9d., or nearly 12 per cent., and this after incorporating the West Ham Gas Company. While 11s. 9d. is not one of the lowest figures, yet it compares very significantly with Dublin; for in 1894 this Company stood at 16s. 9d., and in 1911 at 18s. 2d., or an increase of about 8 per cent. This rate of advance may appear unimportant; but one must realize that 18s. 2d. for a large undertaking is very high. It might be permissible with a small country company; but for one in the category in which Dublin is embraced, there is something to be said.

Take as a further instance the South Metropolitan Gas Company, which in 1894 was 10s. 3d., stood at the modest figure of 8s. 9d. in 1911, or a reduction of nearly 15 per cent. With the figures for the two Metropolitan Gas Companies, one can more fully appreciate the following table, which indicates the capital ratio since the year 1894 for Dublin:—

Capital Employed per 1000 Cubic Feet of Gas Sold.

	s.	d.		s.	d.		s.	d.
1894	16	9	1900	15	11	1906	16	7
1895	16	1	1901	16	3	1907	16	7
1896	16	0	1902	16	4	1908	17	10
1897	15	6	1903	15	8	1909	18	2
1898	15	6	1904	15	8	1910	17	4
1899	15	3	1905	16	1	1911	18	2

Now this statement shows that, during the period of review, the rate was reduced by 1s. 6d. in 1899, but last year shows an increase of 2s. 11d. since then—suggesting that the Company, instead of proceeding on economical lines (as is the case with practically all large British gas undertakings), is receding, instead of progressing.

Let me instance, in a simple fashion, my argument. In the last issue of the "JOURNAL," Dublin 5 per cent. stock was marked 72-77—yielding to the investor the unusually high return of nearly 6½ per cent. One has some difficulty in reconciling the capital ratio with this figure; for when all is said and done it represents about £900 per million cubic

feet, and ought not by itself to be the cause of such an acute depression in the value of stocks. What then is the cause? Is it because the public consider the Company's capital ratio is increasing beyond a reasonable figure, instead of contracting like other big gas companies? If this is so, then the penalty to the proprietors is an extremely severe one. Failing this, what is the cause? Let the following example be considered.

In a recent issue of the "JOURNAL" it was stated that a small undertaking (I should say about one-thirtieth the size of Dublin) had in recent years, by careful management, reduced its capital ratio from £2500 per million to £1400 to £1500; and at a recent sale, the ordinary shares of this particular company sold at an average price which yielded to the buyer under 4¾ per cent. On this basis, Dublin 5 per cent. stock (backed up by a capital ratio of £900 per million) should be quoted at 105, instead of 72; and if receiving the full statutory dividend under the sliding-scale, should be worth well over 110.

This comparison must appeal to all stockholders. At present their investments are standing at at least one-third lower than should be the case, as for every £100 of ordinary stock there appears to be a depreciation of (say) £33, or £330 for every £1000.

I feel sure that all fair-minded people will consider my criticism reasonable, and calls for a reply. Failing, I shall continue (with your permission) to review the Company's affairs from time to time until a satisfactory solution is forthcoming.

In conclusion, may I say, in reply to your correspondent "D. L.," that the points he makes will be dealt with by me in subsequent communications; but this I might say at once, that the enforced reduction he refers to was a contra to a modification of the candle power standard provided in the Company's last Act of Parliament.

NONULUS.

June 5, 1912.

Gas-Leak Indicators.

SIR,—I am indebted to your issue of the 4th inst. for an illustration of a gas-leak indicator for which a patent has been granted to Herren H. Cremer and P. Heinrichs, of Aachen, Germany.

Many of your readers will see that it is exactly similar to Marsh and Thorp's leak indicator which has been on sale for the last twenty years. I enclose you blue print like that usually sent out by me to inquirers.

I shall be glad if you will point this out, as it shows the glaring difference between the methods of the German Patent Office, where every English patent is microscopically scrutinized, and, if possible, refused, and the English Patent Office, where grants are made of such a nature as the one now referred to.

THOS. G. MARSH.

Manchester, June 7, 1912.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Lords Bills read a second time and committed: Brodsworth and District Gas Bill, Christchurch Gas Bill, Derwent Valley Water Bill, Llanelly Rural District Water Bill, Swanage Gas and Water Bill, Wandsworth, Wimbledon, and Epsom District Gas Bill.

Bills read the third time and passed: Belfast Corporation Bill [Lords], Bognor Gaslight and Coke Company (Electricity) Bill, Glasgow Corporation (Water) Bill, Staffordshire Potteries Water Bill.

Petitions have been presented against the following Lords Bills: Christchurch Gas Bill, by the Southampton County Council; Herne Bay Gas Bill, by the Alkali Manufacturers' Association; Wandsworth, Wimbledon, and Epsom District Gas Bill, by the Surrey County Council and the Epsom Rural District Council; York United Gas Bill, by the York Corporation.

The petitions of the Canterbury Gas and Water Company, the Swansea Gas Company, and the Taunton Gas Company against the National Electric Construction Company Bill, and that of the Swansea Gas Company against the Swansea Corporation Bill have been withdrawn.

On the motion of the Deputy-Chairman, it was ordered on Wednesday that the proceedings, on the 22nd ult., on the consideration of the Tendring Hundred Water and Gas Bill [Lords], as amended, be null and void, and that the Bill, as amended, be considered, in connection with amendments proposed by the promoters, on the 10th inst.

The Lighting of the House.

On the re-assembling of the House last Tuesday, after the Whitsuntide recess, a good portion of the sitting was taken up with Supply; and the vote to complete the sum of £50,800 for Houses of Parliament buildings gave rise to some remarks on the proposed alteration of the lighting arrangements. Sir J. D. Rees urged that the change from gas to electric light should not be made until the opinion of members had been ascertained. Mr. W. Benn said it was thought by many members that the present gaslight was not strong enough; and they complained that they could not read their notes. By the substitution of electricity, there would be a saving of £140 a year in the cost of maintenance, and the ventilation of the House would be facilitated. In one of the four bays of the ceiling of the Chamber electric light had been installed experimentally; and he was confident that, in colour and tone, the light would be the same as that produced by gas. If the House should disapprove of the experiment, it would not be continued. Lord Balcarres expressed regret at the contemplated adoption of electric light, which, he said, had not been shown to be necessary. He had been in the House for eighteen years, and had only heard one member complain of the existing light. The view that the present system was dangerous would not, he thought, attract much attention; and a prospective saving of £140 a year was not sufficient justification for a change. He stated confidently that the present system was less fatiguing to the eyes than anything so strong, glaring, and uniform as electricity. The lighting and ventilation of the House were, he believed, infinitely superior to that which could be found in any other place of assembly; and he was not convinced that there was any effective demand among members for a change. Mr. King said in his opinion the substitution of electricity for gas was an urgent necessity. The hon. member raised a laugh by calling attention to the fact that while he was speaking one of the lights had gone out. Mr. Benn said he thought hon. members would be well advised to see what they thought of the alteration which had been made temporarily before they came to any conclusion. They would find it very difficult to say which was illumination by electricity and which by gas. After some further conversation, the vote was agreed to.

South Suburban Gas Bill.

This Bill was down for reading a second time yesterday, but it did not come on. It is, however, placed on the list for this (Tuesday) afternoon, though it is possible it may be again postponed. Mr. Rowlands has been objecting to the second reading for some weeks, on the ground that the price in the "outside areas" should be lower than that now in the Bill. Particulars have already been given in the "JOURNAL." The Company have endeavoured to meet Mr. Rowlands by making certain reductions which would be placed before the House of Commons Committee; but apparently he is not yet satisfied. Mr. Handel Booth has also been opposing on a small point, and he has been met. By the Bill, a consumer must give written notice of a desire to have the supply discontinued; but Mr. Booth wishes a personal call to be equivalent to written notice, and this has been agreed to.

Objection to Gas Companies' Pension Schemes.

The Brighton and other Gas Companies' Bills containing provisions for the establishment of pension funds were down for second reading on the re-assembling of the House last Tuesday, but they were blocked by Mr. Handel Booth, the Liberal Member for Pontefract. This proceeding drew from the Brighton Correspondent of the "Daily Telegraph" the following remarks: "The action of Mr. Handel Booth, in holding-up the Brighton and Hove Gas Company's Bill, with others of the same class, in the House of Commons on Tuesday, has caused much amused interest in this district, as reflecting the methods of the Radical politico-sociologist. The Brighton Bill has nothing to do with gas as an illuminant. It is simply a Model Bill by which a number of similar undertakings are regularizing a scheme of benevolent consideration for their employees, particularly old servants and the dependants of men who have died in the service. So far as Brighton is concerned, it virtually sets aside £3500 per annum for a permanent pension and allowance fund, equal to double the amount now distributed in such cases. The provision will be an inestimable boon to probably a thousand people in Brighton and Hove alone. It is true the Town Council originally opposed the Bill on the ground that the fund should be built up out of reserves. But it was pointed out that in either case the source would be revenue; and the House of Lords Committee passed the Bill without even calling upon the promoters to reply to this criticism. The action of the Gas Company is generally regarded as affording at least one example of the way in which labour unrest may be allayed. Mr. Handel Booth's objection would seem to be that this scheme is immensely more popular in the district than the Insurance Act."

The Co-Partnership Question.

A preliminary meeting was held last Wednesday at the House of Commons to arrange for a larger meeting to-morrow with a view to the promotion of co-partnership. Lord Grey, who is the President of the Labour Co-Partnership Association, was to have taken the chair; but in his unavoidable absence Lord Robert Cecil presided. Among those present was Mr. Charles Carpenter, the Chairman of the South Metropolitan Gas Company. The object in view is to develop the industrial side of the co-partnership movement. All the signatories to the recent House of Commons memorial on this subject – nearly 300 in number—as well as some who are interested in the movement but are not members, will be invited to the meeting to-morrow. Mr. James Hope, the Conservative Member for Central Sheffield, has given notice of his intention to move to-morrow for leave to bring in a Bill "to promote the adoption of co-partnership by statutory and other companies."

Legal Expenses of Local Authorities.

A Bill has been introduced by Sir Ryland Adkins to enable local authorities to contribute towards the expenses of legal proceedings and private and other Bills involving questions of common interest. In a "Memorandum" attached to the Bill, it is remarked that in the administration of local government it very frequently occurs that some point of law requires elucidating by a judicial decision. In present circumstances, some one local authority is obliged to bear the whole brunt of such action as is necessary; and, as the decision of a Court of First Instance is seldom sufficient in such a case, the expenses are usually considerable. The Bill is intended to make it possible for all local authorities interested to share the expenses of such a test action, which is carried on for the benefit of the whole community, and so to minimize the burden. As similar cases may arise in the course of proceedings relating to Private Bills and Provisional Orders, clauses are introduced to meet these cases also. The Bill is approved by the County Councils Association of England and Wales, the County Councils Association of Scotland, the Association of Municipal Corporations, and the Urban District Councils Assocation.

Gas Profits at Bradford.—The City Treasurer (Mr. F. Ogden Whiteley) has submitted a financial statement to the Bradford Gas Committee, showing that the profit on the undertaking to March 31 last amounted to £9618, as compared with £12,935 in the preceding year. This result was considered satisfactory, having regard to the manner in which the Committee were handicapped during the coal strike. The income from the sale of gas is £419 less; while coal cost £2826 more. This is entirely accounted for by the strike. Increases of wages to stokers and others engaged in the manufacture of gas amounted during the year to £2073.

MISCELLANEOUS NEWS.

GASLIGHT AND COKE COMPANY'S CENTENARY.

The current number of the "Co-Partners' Magazine" of the Gaslight and Coke Company opens with a few personal particulars in regard to the General Manager (Mr. D. Milne Watson), whose portrait is given as a frontispiece; and after them comes the following article on the Company's centenary.

This month, as in duty bound, we are thinking and talking mostly about the centenary of our wonderful Company, and are preparing to take a fitting part in the noble festivities with which the grand event is to be celebrated. Our generous-hearted Directors, as will be seen by the notices posted in the stations and district offices, mean to do the honours of the occasion in the most liberal spirit; and it only remains for us, their willing guests, to respond worthily with heart and hand to their overflowing goodwill. For, however bountifully the board may be spread, it takes the two parties, hosts and guests, to make a real feast. Wherefore, let no responsiveness be lacking, but may all who share in these Centenary festivities feel in their hearts that it is a right good thing to rejoice in this auspicious event—unprecedented in the industrial world, and not likely to be paralleled in our time.

In whatever aspect we may regard the occasion, it is one of tremendous significance. Here, we may say, stands our Company, after a hundred years of toil and trial, stronger in every respect than it has ever been, in unequalled repute, and better equipped than ever before for discharging its enormous responsibilities to the people of London. Born in weakness, nurtured in poverty, frowned upon by the wise in their own conceit, struggling to fulfil its destiny through evil and through good report; gaining strength from its adversities, learning wisdom from its vicissitudes, never shrinking in face of difficulties; overcoming obstacles, shedding mistaken counsels; holding fast to the simple rule of fair dealing. How many ventures, starting off with greater promise and more apparent advantages, has it passed by the way! What prophecies of disaster has it survived! Its simple manufacturing processes have been lightly spoken of by the Supermen of Science; but its products have won their way more and more into the appreciation of the most exacting community in the world. It has preserved throughout its long and useful existence the best attributes of youth—adaptability to circumstances, and readiness to learn new and approved methods. It has not merely falsified the mistrust and the doubts that surrounded its first beginnings, but it has also in these latter days acquired fresh elements of vitality, and put forth new internal and external developments that challenge the admiration of its most progressive contemporaries in our social and industrial systems.

It is now not merely a Company, in the legal sense; it is also a Companionship, in a far wider sense. In the long history of the gas industry of the United Kingdom in general and of the Metropolis in particular, three portentous eras stand out as turning points in this record of success. The first was the districting, which enabled gas undertakings to cultivate their domains in peace; the second was the institution of the sliding-scale and auction clauses, which made the consumers sharers in the prosperity of the companies, and opened the proprietorship to the public; and the third is the adoption of Co-partnership, which embodies all three constituents of the undertaking—owners, customers, and employees—in one united Brotherhood in the cause of Good Service. The first step made the following ones possible; the second was a measure of realization; the third is a consummation. Again, the first stage is completely finished; the second is in progress; the third is an opening into the future. The Age is, as ever, in a state of transition. Epochs of time are of man's observation—mere convenient divisions of an ever-moving experience which itself knows no points of demarcation. We can never call a halt, still less arrive at a stage where we may "rest and be thankful." Our Centenary will pass; but it will be our own fault if it leaves us plodding on without an inspiring memory, which we shall be proud of sharing with so great a host of our co-partners, and will be another tradition of the service to hand on to our successors.

NOTTINGHAM GAS PROFITS AND RATE RELIEF.

Protest against Undue Appropriations.

[From Our Nottingham Correspondent.]

Angry recriminations appear to be inseparable from discussions relating to the administration of the Nottingham Corporation gas undertaking. The fact was again evidenced in a significant manner at the meeting of the City Council on Monday last week, when the annual report of the Gas Committee was brought under review, leading to some trenchant criticism by Mr. E. Harlow, who raised a protest against the manner in which the profits are being "raided" in support of the rates. He quoted from a recent article in the "Journal" [*ante*, p. 497] in support of a contention that the matter is one which, upon general grounds in relation to the protection of consumers, calls for Government action. Mr. Harlow's interposition was interesting, as recalling some incidents of the stormy period which led to the inquiry as to the management of the undertaking by the former Engineer (Mr. J. H. Brown). At that time, Mr. Harlow occupied the position of Chairman of the Gas Committee; and he lost his seat practically by reason of the attitude he then took up as to the conduct of the works. His return to the Council, after what has been, figuratively speaking, a somewhat lengthy sojourn in the municipal wilderness, presents the prospect of a revival of controversy in a somewhat acute form. At any rate, the prospect was not lessened at the last meeting, when Sir Edward Fraser protested against the "insolent" tone which, he alleged, Mr. Albert Ball, the present Chairman of the Committee, adopted in his reply to Mr. Harlow. It was, curiously enough, the occasion of Mr. Ball's *début* in an aldermanic capacity. He had only an hour previously been elected to fill a vacancy on the upper benches; and his first important speech led to a feeling of embitterment which was scarcely in consonance with the occasion. Mr. Harlow, basing his argument upon well-arranged facts and figures, sought to establish the contention that, despite the large sums drawn from the gas undertaking in relief of municipal burdens, the financial results achieved by no means warranted the roseate pictures which had been presented as to the revenue-earning capacity of the undertaking—by far the largest of the Nottingham Corporation's trading concerns.

Mr. Harlow's speech dealt with the matter from the point of view of treating the undertaking as if it were worked by a limited company; his criticism being directed to showing how entirely disproportionate the results were to the large capital sum invested. A point upon which he laid especial emphasis was that whereas the consumption of gas had increased by 58 per cent., the cost of management had nearly doubled. At the same time, 2½d. per 1000 cubic feet more had been charged. It meant, therefore, according to his estimate of the position, that, despite this increase in price, and the fact that the business had been augmented to the extent stated, the Gas Committee would, if dealing with it as directors of a private concern, have been able to pay only 10s. more per cent. upon a largely increased capital, which in 1890 was represented by upwards of £900,000, and now stands higher than a million. Mr. Harlow's justification for the criticism was presented in his avowal that there could not be a more opportune time for it than the present, when a new Engineer and Manager has entered upon his duties. He disclaimed all personal feeling.

Mr. Ball's reply was in the nature of a *tu quoque*, which gave rise to Sir Edward Fraser's indignant protest. The newly-elected Alderman twitted Mr. Harlow for his failure to allude to the proportion of profits taken in aid of the rates when the concern was under his chairmanship, and accused him also of having then got things into a beautiful muddle. But the points which the former Chairman had emphasized had been well driven home; and the debate strengthened the impression that, whatever may be the records of the two political parties in Nottingham in regard to "milking" gas profits in aid of the rates, the system, from the gas consumers' standpoint, stands condemned as being flagrantly inequitable.

Discussion in the City Council.

At the Meeting of the Nottingham City Council on Monday last week, the annual report of the Gas Committee, some extracts from which appeared in the "Journal" for the 21st ult. (p. 531), gave rise to a stirring debate.

Alderman A. Ball, in moving the adoption of the report, observed that the gas undertaking was in a very sound condition. There was an increased consumption of gas last year amounting to 43,676,000 cubic feet, while the number of consumers had been augmented by 1562. Many important reductions had been made in the interests of consumers during the last few years. In 1909-10, the rebate made to those using prepayment meters amounted to £2380. In 1910-11, the rebate to ordinary and prepayment consumers was represented by £10,560; while in 1911-12, it was £14,590. In the period mentioned, therefore, the total reduction to consumers had been £27,530. A reduction of 1d. per 1000 cubic feet on the City's consumption meant £6500. When, consistently with the good management of the undertaking, the Committee could see their way to effect further reductions, they would be delighted to do so.

Mr. G. O. Richards, one of the representatives of the Independent Labour Party, protested against the charge made for meter-rents, and asked when it was proposed to abolish it. He said the fact that so large a sum as £39,000 was being taken from the profits of the gas undertaking in aid of the rates precluded the possibility of any concessions being made either to the consumers or to the employees of the department.

Mr. E. Harlow said it would be remembered that six years ago he was Chairman of the Gas Committee; but, with several other members, he resigned because a certain policy which he advocated was not sanctioned. Since that time, however, the present Committee had adopted it. He desired, as a matter of special importance, to invite the Council's consideration of the fact whether the results embodied in the report submitted were quite so real and satisfactory as they appeared to be on the surface. He took for the purpose of comparison the report for the year 1890, which was the earliest he possessed. The figures which he desired to bring under notice formed, he thought, something in the nature of a startling revelation, when they were contrasted with those for the last financial year. In 1890, the number of cubic feet of gas sold was 1293 million; while in 1912 it was 2050 millions—showing an increase of 757 millions, or 58 per cent. The prime cost of manufacture per 1000 cubic feet sold in 1890 was 10·35d. for coal, and 0·76d. for purification; the corresponding figures for 1912 being 10·43d. and 0·38d. Therefore, though there had been an increase to the extent of 58 per cent. in the quantity of gas consumed, the cost of purification was less than when they had the smaller amount. This might be due to one of two causes—to the difference in manufacture, or to the city not getting its gas in as pure a condition as in the past. In 1890, the cost of wages for carbonizing was 3·66d. per 1000 cubic feet of gas produced, and in 1912 it was 2·08d.—a saving of 1·58d. This represented £19,731 and £17,792 respectively. Improved methods might account for the decrease in wages; or, on the other hand, it might be due to the fact that a large quantity of water gas—equal to 3½ per cent. of the total output—was now made. In 1890, repairs and maintenance cost 3·32d., and last year 5·69d.; this representing the only increase in cost. In 1890, the total cost of manufacturing was 1s. 6½d. per 1000 cubic feet; and in 1912, 1s. 7d. Compared with 22 years ago, therefore, though there had been an increase of 58 per cent. in the sales of gas, and 3½ per cent. was water gas, the total cost of manufacture was ½d. per 1000 cubic feet more. In 1890, the cost of distribution was 2·31d., compared with 4·97d. Cost generally diminished with increased output; but in this instance it had increased by 2·66d. Management expenses per 1000 cubic feet were represented in the year 1890 by 1·01d., and in 1912 by 1·20d.—or

equivalent respectively to £5422 and £10,209. It was certainly a surprising feature that the management expenses should have doubled; and he suggested that there was decided room for reduction in this respect. In 1890, the total expenses were 1s. 11d. per 1000 cubic feet; and in 1912, 2s. 3¾d.—an increase of 4¾d., despite the huge increase in the output. As to receipts, the price charged to consumers in 1890 was 2s. 1·65d. per 1000 cubic feet; while in 1912 it was 2s. 3·9d.—an increase of 2·25d. In 1890, the receipts from residuals came to 7·27d. per 1000 cubic feet; and in 1912 to 9·51d. In Nottingham, the residuals yielded £7819 less than the cost of coal; whereas in Sheffield they produced £24,457 more. The total receipts per 1000 cubic feet were 3s. 0¾d. in 1890, and 3s. 4¼d. in 1912—an increase of 3⅜d. The excess of receipts over expenditure was 1s. 1½d. in 1890, and 1s. 0⅝d. in 1912. Although there had been an increase of 58 per cent. in business, and 2½d. per 1000 cubic feet more was charged for the gas, the profits were ⅜d. per 1000 cubic feet less. Supposing the undertaking, instead of being worked by the Corporation, had been in the hands of a private trading company, what, upon the basis of the figures quoted, would have been available for dividend? The following were the figures:

	1890.	1912.
Capital employed	£918,422 ..	£1,172,445
Gross manufacturing profit . .	72,426 ..	106,595
Earnings on capital, about . .	£7 16s. p. ct. ..	£9 p. ct.

Therefore, though consumers were paying 2½d. per 1000 cubic feet more for gas, and there had been an increase in business to the extent of 58 per cent., they were in the position of being able to pay only a little over 20 per cent. more in dividends on the capital invested. He urged that Nottingham consumers, compared with those in other towns, were paying for their gas far more than they ought to be called upon to pay; and he urged upon the Committee the reasonableness of reducing the price. Whereas in Sheffield this was only 1s. 3d., and in Plymouth 1s. 9d., in Nottingham it was 2s. 4d. The speaker quoted from the article which appeared in the "JOURNAL" for the 21st ult. (p. 497) on the subject of raiding gas profits, and expressed his hearty agreement with the remarks made as to the inequitable nature of the practice of appropriating gas profits, and said he concurred also in the view that it would be well if some notice were taken of the matter by one of the responsible Government Departments. The undue raiding of gas profits, he contended, amounted, as had been said, to a serious scandal. The profits were extracted to a large extent from the pockets of the poor, and applied to relieving the rates of the better-to-do classes of the community. Small manufacturers, small shopkeepers, and the poorest citizens were being taxed in this way out of all proportion to their means; and, bearing in mind that existing industries generally were being sacrificed, and new ones prevented from coming into the city by reason of the present pernicious system of charging too much for gas, he thought there was no reason why, if proper consideration were given to the matter, the price of gas might not before long be very considerably reduced.

Mr. H. G. FORD suggested that Mr. Harlow had scarcely taken a fair period for comparison; for between 1890 and 1912 the whole system of gas manufacture in Nottingham had been remodelled. It was a false comparison also, in his view, to deal with the cases of Sheffield and Nottingham. The fact must not be overlooked that Sheffield was much more favourably situated than Nottingham with regard to its coal supply, and that also, the town possessing large steel-works, the Gas Company had an exceptional market for sales of their residuals. As to the reduction in charges suggested by Mr. Harlow, the very large capital invested in the gas undertaking at Nottingham—amounting to more than a million sterling—must not be lost sight of. The ratepayers were practically in the position of shareholders; and, if they were to be so treated, it was unfair to suggest that only a small percentage of the profits should be devoted to the alleviation of local burdens. Under all the circumstances, he thought the Finance Committee were perfectly justified in asking the Gas Committee for an additional sum.

Mr. H. CULLEN appealed to the Committee to take into their serious consideration the abolition of meter-rents charged to both ordinary and prepayment consumers. He said it was only because the Committee had the monopoly of the gas supply that such indefensible charges as were now made were rendered possible.

Mr. E. RICHARDS said the important questions which to his mind had to be determined regarding the whole matter were what was a fair profit for the Corporation to keep, and what price should be charged for the gas. They had made 30 per cent. profit; and he thought everyone would agree that this was too much. He should like to know how it was that while the profits from the undertaking this year were £4000 less than in 1910, £4000 more was being taken. This meant a difference of £8000 to the Committee. He urged that, in fairness to small consumers, meter charges should be abolished.

Alderman BALL, replying upon the discussion, said, with regard to Mr. Harlow's observations, he did not propose to spend much time upon them, as he had taken for comparison with 1912 figures for 1890—years before he (the speaker) came to the Council, and years before Mr. Harlow thought much about the matter. He had not, however, mentioned anything about the year 1905, when a beautiful muddle was made, which would take them years to get over. He had also omitted to say anything about the cost of gas production then and now. He would not take up any more time in replying to a statement which Mr. Harlow had evidently spent months in preparing. The Gas Committee were doing their best, and he would strongly advise Mr. Harlow to give them the benefit of his experience. He was like a good many other men. He could give them figures "by the mile;" but when it came to a matter of practical common sense, it was another affair.

Sir EDWARD FRASER protested, and asked for the Mayor's ruling upon what he characterized as Mr. Ball's insolent manner of replying. He said it did not conduce to good feeling, nor to the proper transaction of their business.

Alderman BALL contended that Mr. Harlow's criticism of the report had been of a very unfair character. Replying to other speakers, he promised to bring before the Committee the question of the abolition of meter charges.

The report was then adopted.

At another stage of the proceedings, three of the Liberal members of the Council who had withdrawn from the Finance Committee as a protest against the way in which the allocation of profits from the gas undertaking had been made, consented to serve again upon the Committee; and they were re-elected.

Alderman Ball on his Defence.

The appointment of the Chairman of the Gas Committee to a seat on the aldermanic bench has occasioned a vacancy in the representation of one of the most important of the sixteen wards into which Nottingham is divided for municipal purposes; and in the bye-election, which is occasioning a spirited contest, the administration of the gas undertaking is coming in for a large share of attention. At a meeting held at the Ilkeston Road Schools, on Friday night, Alderman Ball took the opportunity of reverting in considerable detail to the debate in the Council on the previous Monday; saying that but for political purposes they would never have had the nonsense and misstatements which had emanated from Mr. Harlow. Contrasting with present methods the administration of the undertaking when the Liberal party were in the majority on the Council, Alderman Ball claimed that considerably improved financial results had of late years been obtained, thanks to better management. To-day there was a record reserve of £149,400, and a renewals fund of £34,000, which had been taken out of revenue for the rebuilding and remodelling of the works at Radford. Mr. Harlow had complained of the cost of distribution being excessive compared with 1900. In that year, it was 2·31d. per 1000 cubic feet; in 1905, when Mr. Harlow himself was Chairman of the Committee, it was 5·15d.; while it was now 4·97d. Mr. Harlow had criticized the receipts from residuals. In 1890, the amount obtained under this head was 6s. per ton; whereas in 1912, under the "bad management" of the Conservative party, they had received 8s. 9½d. per ton. Now that the controversy has been revived in its acutest form, a great deal more is likely to be heard about the administration of the gas undertaking during the present bye-election campaign in Nottingham.

WEST BROMWICH GAS UNDERTAKING.

The Past Year's Working and Ten Years' Progress.

The annual accounts of the Gas Department of the West Bromwich Corporation were submitted at the meeting of the Town Council last Wednesday.

Mr. J. BROCKHOUSE, the Chairman of the Committee, said the gross profit for the year ended March 31 was £14,242, and the net profit £5839. The revenue showed a very satisfactory increase, particularly from the sales of residuals; and the total income amounted to £57,581. The working costs were £43,339, in addition to which loan charges amounted to £8403. From the profit of £5839, the Committee recommended that £2854 should be transferred to extinguish the balance on the extensions suspense account; £500 had already been voted in aid of the district rate; and it was proposed to carry forward £2485. He would like to review briefly the previous ten years, and bring to the notice of the Council a few important facts. The extensions suspense account stood at £22,000 ten years ago; and they were now clearing off the balance. The whole of the amount named had been paid off out of revenue. In the last ten years, £9000 had been granted in relief of the rates; and from the commencement of the undertaking, £36,000 had been transferred for this purpose. Considerable outlay which could properly have been charged to capital had been met out of revenue, in order to keep down the amount of the capital expenditure. For instance, the office extensions at the Town Hall, the purchase of mines near the gas-works, new coke plant and stoking machinery, the extensions to No. 3 holder, and the new water-gas plant, representing an outlay of £12,700, had all been paid for out of revenue. The loan debt outstanding had been reduced from £180,441, or at the rate of 11s. 8d. per 1000 cubic feet of gas, to £129,207, or 7s. 7d. per 1000 cubic feet. Of the total expenditure of £241,066, revenue had up to the present provided £125,296, or more than one-half. The number of consumers was nearly 1600 more than it was ten years ago, though the increase in the output of gas only amounted 26 million cubic feet. The average quantity of gas sold per consumer during the past year was 28,000 cubic feet; whereas in Birmingham it was 50,000 cubic feet. The plant was of sufficient capacity to turn out 50 per cent. more gas than was sold last year; and the Committee were anxious to do everything possible to increase the sales to this quantity. He considered that, if they could increase by one-third, their total cost per 1000 cubic feet would be considerably reduced. The cost of the maintenance of the prepayment meters and fittings had increased from 1s. 6d. to 2s. 10d. per meter per annum, or nearly 100 per cent. in ten years. He reminded the Council that no profit was again made on the public lighting account—in fact, he asserted that the cost exceeded by £1200 per annum the amount charged; so that, in effect, the gas undertaking made in aid of the rates a yearly contribution of this amount, apart from the sums which were specially voted. The Committee had during the year granted increases of workmen's wages amounting to £520 per annum; and the proportion for the past year was £240. The result of the past year's working was very satisfactory, especially in view of the fact that they were seeing the last of the suspense account, which had been hanging over them for so many years.

The accounts were approved, and a warm tribute was paid by Mr. Brockman to the excellent services rendered by the Gas Engineer and Manager, Mr. Harold E. Copp.

Report of the Engineer and Manager.

The report of Mr. Copp for the year ended the 31st of March last furnished the following particulars.

The cost of maintenance of the works during the year amounted to £4325, compared with £4002 during the previous twelve months. The former sum includes the purchase and installation of the boilers obtained

from the Electricity Department to replace the defective boilers in connection with the water-gas plant. The cost of the whole work amounted to £990, including boiler-house, setting, and all accessories. Had the boilers not been installed, the continuity of the production of water gas would have been endangered; and during the coal strike such a contingency would have been extremely serious. The repairs and maintenance of stoking machinery and electricity generating plant amounted to 1·18d. per ton of coal carbonized, compared with 1·07d. during the previous year and 1·43d. in the year 1909-10. The number of units generated was 8729. The gas used on the works amounted to 5,861,000 cubic feet, compared with 5,928,000 cubic feet in the previous year.

Substantial concessions and increases in wages to practically all grades of the men employed at the works were granted during the year. The carbonizing wages amounted to £2317, or 1·52d. per 1000 cubic feet of gas made, compared with £2055, or 1·38d. per 1000 feet, before. The coal carbonized amounted to 27,798 tons (including 939 tons of cannel), yielding 316,255,000 cubic feet of gas, or 11,376 cubic feet per ton, compared with 25,696 tons, yielding 296,150,000 cubic feet, or 11,404 cubic feet per ton, in 1910-11. At the end of the coal strike, the stocks were very seriously depleted; in fact, during the year no less than 5200 tons were used from stock. This doubtless to some extent adversely affected the yield of gas per ton. Notwithstanding the fact that some considerable quantities were purchased at an enhanced price previous to the strike, the average cost of coal was 2d. per ton less last year than during the previous twelve months; the coal purchases in June having been effected at more favourable prices than those of the previous year.

The cost of water-gas manufacture amounted to £2508, or 12·27d. per 1000 cubic feet, compared with £2732, or 10·63d. per 1000 cubic feet, during the previous year. The quantity of coke used in the production of water gas was 770 tons, yielding 49,045,000 cubic feet; and the quantity of oil, 121,787 gallons, compared with 120,593 gallons. The percentage of water gas used was 13·4, against 17·2. The benzol used for enrichment amounted to 6118 gallons, compared with 22,898 gallons; the decreased quantity being due to the prohibitive price of benzol. Most of the enrichment, therefore, was effected by the use of water gas. This accounts for the somewhat increased cost as compared with the previous year. The average illuminating power of the water gas was 21·15 candles. Mr. Copp points out that the test-burner used is quite unsuitable for testing both water gas and mixtures of this and coal gas, as it gives a result very much less than the true candle power. Hence the necessity of making water gas as high as 21-candle power. Where such mixtures are used, the town gas should, he says, certainly be tested with the No. 2 "Metropolitan" burner. During the first three months of the year, on account of the coal strike, heavy percentages of this high candle power water gas were used. The cost of gas production was consequently higher than it would otherwise have been. The total quantity of gas made was 365,300,000 cubic feet. The average calorific power was 615 B.Th.U., compared with 627 B.Th.U. during the previous year; and the average illuminating power was 15·59 compared with 16·57 candles.

The total wages at the works amounted to £6114, or 4·01d. per 1000 cubic feet, compared with £5812, or 3·89d. per 1000 cubic feet, in 1910-11. The total manufacturing charges were £32,488, compared with £30,852. The coke produced amounted to 16,293 tons, against 15,510 tons before. The yield of tar was 10·7 gallons per ton of coal carbonized, and of ammoniacal liquor 30·7 gallons, compared with 11·5 and 29·33 gallons respectively. The sales of coke amounted to £11,185, compared with £9172; of tar, to £1734, against £1700; and of ammoniacal liquor, to £2964, compared with £2234—the total amount realized for residuals being £15,994, against £13,512.

Notwithstanding the effects of the coal strike on the trade of the town, there was an increase in the sales of gas amounting to 9,959,355 cubic feet, or 3 per cent.; and Mr. Copp suggests to the Gas Committee the advisability of adopting suitable means to further augment the sales of gas and to popularize its uses by all classes of consumers. The sales in the fittings department amounted to £1707, compared with £1307; and evidence was afforded that the show-room in High Street is appreciated by an increasing number of consumers. The number of gas-stoves fixed during the year was 130, against 114 in 1910-11; and of gas-fires 51, compared with 54. The number of meters fixed was 237, against 377.

The wages in the distribution department amounted to £2700, against £2549. The total number of public lamps is 1100 (of which 943 are fitted with incandescent burners), compared with 1098 in 1910-11. The unaccounted-for gas amounted to 17,629,426 cubic feet, or 4·82 per cent., compared with 19,971,781 cubic feet, or 5·58 per cent., before. A new compressing plant has been installed in a building at the rear of the show-room, and high-pressure gas will be available for consumers in High Street. The Committee have recently decided to let on hire high-pressure lamps on very favourable terms; and the hope is expressed that during the coming winter the consumers will avail themselves of the latest and most important development in the use of gas.

HINCKLEY DISTRICT COUNCIL GAS UNDERTAKING.

Record Profits and Gas Consumption.

The Gas Engineer and Manager of the Hinckley Urban District Council (Mr. Fred Lee) presented to the Council last Tuesday his report for the year ended the 31st of March. It shows that the gross profit was £6112, and the net profit £3635. The receipts for gas were £12,478; and residual products and fittings yielded £3750. The total expenditure on capital account was £2143, the whole of which was paid out of the profits, as was also £750 spent on special renewals. A sum of £1707 was transferred to the general district fund, £650 was used in reduction of the rates, and £1057 (taken from the deposit account) was spent in the purchase of land opposite the gas-works. The bulk of coal carbonized was 8750 tons, and the quantity of gas manufactured was 95,206,000 cubic feet, of which 91,980,400 cubic feet were sold—an increase of 6,734,500 cubic feet compared with the year 1910-11. Of this, 3,555,200 cubic feet had been used for the production of power, &c. The storage capacity of the works was increased by 200,000 cubic feet by the addition of a lift to one of the holders. Tar plant, erected at a cost of £210, for the purpose of dehydrating the tar, will enable the Council to supply prepared tar at a reasonable price to road authorities. The public lamps in the town (with the exception of 14 fitted with clockwork) are lighted by pressure. This system has been in use for some months, and is stated to have worked very satisfactorily.

The adoption of the report was moved by Mr. Kinton, who said the profits made and the quantity of gas consumed constituted records in the history of the undertaking; and the prepayment meters and fittings had been a great success. The Gas Committee recommended a reduction of 1d. per 1000 cubic feet in the price of gas—from 2s. 9d. to 2s. 8d. in Hinckley, and from 3s. 1d. to 3s. in Burbage. The report was unanimously adopted.

LINCOLN GAS AND WATER SUPPLIES.

At the Monthly Meeting of the Lincoln City Council last Tuesday, statistics were submitted showing the results of the working of the various Corporation undertakings for the past financial year.

In presenting the minutes of the Gas Committee, Alderman Wallis (the Chairman) pointed out that, instead of an estimated sum of £1838, there was £2141 to carry forward, or within £227 of the year before; while the reserve fund was now brought up to £8706. They had spent on new cookers and meters £1600; and they had had a very large outlay in repairs, retort-settings, &c., amounting to £2245. They were spending about £1100 this year; and after this was finished, they would have done, as far as they could see, with expenses of this kind. In future they would have all that they made, except for ordinary expenses, and would be able to apply this to the reduction of the rates or to lowering the price of gas. Though they could not, of course, say what the price of coal would be, they were in a good position with regard to the future. The statistics in the report of the gas undertaking showed that the gross profit was £15,558, compared with £15,966 in the previous year, and that, after deducting interest and sinking fund charges, the net profit was £7855, a decrease of £297 compared with the year before. The reduction of 1d. per 1000 cubic feet of gas reduced the revenue by approximately £900; while the restriction of the supply during the coal strike entailed a further reduction of revenue. These items together more than accounted for the total reduction of £1115. The income from the sale of residuals showed an increase of £1323, and rent of cookers and miscellaneous items an increase of £60; the total income from all sources being £51,645—an increase of £278 compared with the previous year.

In the City Accountant's report upon the water accounts for the past year, it was stated that the receipts on revenue account, including the balance of £2793 brought forward, were £31,540, and the expenditure £30,739, leaving a balance on March 31 of £801. The rate in the pound was 2s. 4d. within the city, and 3s. 4d. outside, which was an increase of 4d. in the pound in each case on the previous year. The deficit on the year's working at these rates amounted to £1992, the whole of which was taken from the balance in hand at the beginning of the year. The increase of 4d. for the supply for domestic purposes, together with a small increase for domestic extras, yielded an increase of £3226; the supplies by meter, meter-rents, and water for building showed an increase of £187; and the miscellaneous items of receipt, an increase of £50, or a total increase of £3463. In expenditure the largest item was £3430 for "service of debt;" and the net increased expenditure was returned at £4340. On the capital account, the figures showed that £51,120 was spent during the year in respect of the Elkesley supply, and £1438 in respect of the Staveley action. The balance from last year's account was £6654, making the total to be provided £59,212. The report added that the capital expended amounts to £394,019, and that the liability in respect of this sum is now £303,841; the difference of £90,178 representing the loans repaid, the sinking fund accumulations, and capital expenditure met by revenue account.

BOLTON TRADING COMMITTEES AND RATE RELIEF.

Just ten years ago, the Bolton Town Council approved of a resolution of the Finance Committee to the effect that the yearly contribution from the trading committees in aid of the rates should not be less than 2½ per cent. on the existing loan capital, as on the previous March 31; any balance of profit being carried to the reserve fund. At last Wednesday's meeting, Alderman Brown (the Chairman of the Finance Committee) suggested a change of policy in presenting his annual budget statement.

In the course of his remarks, Alderman Brown said that, under the resolution of 1902, no contribution whatever would be expected from any of their trading departments when the debt on the undertaking was redeemed; and he thought members of the Council would see the unfairness of this, when they remembered that all their undertakings were being maintained in fullest efficiency, while the debt was being steadily redeemed. An undertaking was expected to make profits in proportion to the capital put into it, not on what its mortgages were; and in their case the fact that the debt of one undertaking was being redeemed by way of sinking fund operated unfairly against that department as compared with a department redeeming its debt by repayment of annual instalments of loans. Therefore he suggested a change of policy in this respect, and that any money spent on trading undertakings must be expected to be remunerative. The resolution of 1902 said that the balance of profit remaining after paying the 2½ per cent. should go to the reserve fund. Since this resolution was passed, however, the contributions towards the depreciation and renewals funds of their trading undertakings had been placed on a sound basis; and these charges in respect of depreciation and renewals were not contingent on the 2½ per cent. being given in aid of rates, but were taken as an expense of working before any sum at all was allocated to

the rates. The depreciation and renewals funds in hand at March 31 last were as follows: Gas-works, £37,015; electric supply, £27,674; tramways, £45,920; and markets, £240—a total of £110,849. As the yearly contributions to these funds were based on an estimated depreciation of plant, he considered that an inquiry might very well be made into the sufficiency, or otherwise, of these funds—especially taking into account the fact that for about twelve years they had been depreciating at such rates as 10 and 7 per cent. Turning to deal with the increases in some of the district rates, he said they were chiefly due to the lamentable coal strike that upset the trade of the country in March. Last year the Electricity Committee thought they would be able to grant the sum of £6500 in aid of the district rates; but, on making up the accounts for the year, it was found that, after providing for depreciation and loan charges, the sum of £3250 only could be allocated towards the relief of the rates. The estimated amount from the undertaking for next year being £5000, this meant a total loss to the rates of £4250, which was nearly equal to a 1½d. rate in all the districts of the borough. The full income from trading undertakings this year in relief of rates was £36,398, against an estimated sum of £39,000; and for 1913 it was estimated that £39,000 would be available. From the gas undertaking, £20,000 was promised for the year ended March 31 last, and handed over; and for the current year the estimate was again for £20,000.

The budget statement was approved of without any discussion.

WARRINGTON GAS UNDERTAKING.

The report of the Gas Committee presented at last week's meeting of the Warrington Town Council showed a net profit of £16,367 on the past year's working of the department; this being an increase of over £5000 upon the preceding twelve months. On the water undertaking, there was a gross profit of £20,920. Interest on loans and contribution to sinking fund absorbed £19,336, leaving a net profit of £1584. Following the submission of these and other reports, there was a discussion on the question of allocating to the relief of rates large sums out of profits made by the trading committees.

In congratulating the Gas Committee upon the splendid result achieved, Alderman A. Bennett said he was a great believer in municipal trading concerns, which had been subjected to much ignorant and unnecessary criticism. In his opinion, the time had arrived when municipal trading would be extended in directions previously undreamt of, and a means thus afforded of dealing with problems that afflicted them to-day. The chief argument raised against municipal trading was that municipalities were not able to manage the concerns as successfully as would be the case if they were in private hands. It appeared to him that the report of the Gas Committee now before them was conclusive proof to the contrary. They were making enormous profits, and at the same time steadily reducing the price of their product, besides giving an admirable service to the public. The total amount paid to the relief of rates from the profits was £128,000, providing ample justification of the enterprise of the Committee. While the Electricity Department showed a profit of 7 per cent., the water undertaking 5 per cent., and the tramways 8 per cent., the gas-works had a profit of 11 per cent.

Mr. J. Pemberton argued that it was wrong to advance the rates 2d. in the pound when such large sums had been placed to reserve from profits made by the trading committees. On the other hand, Mr. J. Wilkinson submitted that there was no reason why, to save the rates, they should filch the profits of their several undertakings, and thereby bring these concerns into financial jeopardy.

The reports were approved.

BRIGHOUSE CORPORATION GAS DEPARTMENT.

The Past Year's Working.

The Gas Engineer and Manager of the Brighouse Corporation (Mr. Harold Davies) has presented to the Gas Committee his report for the year ended the 31st of March. It shows that the total quantity of gas sent from the works was 3,392,000 cubic feet, or 2·14 per cent., more than in the year 1910-11. In the quantity sold there was an increase of 1,919,900 cubic feet, or 1·21 per cent. The total gas delivered was 161,722,000 cubic feet, of which 150,841,900 cubic feet were sold or used on the works; leaving 10,880,100 cubic feet, or 6·72 per cent., unaccounted for. This was rather more than in the preceding twelve months; and Mr. Davies attributes it entirely to the atmospheric conditions of the September quarter. The average make of gas per ton of coal carbonized was 10,840 cubic feet; and had it not been for the unsettled condition of affairs in the coal trade during the last three months of the year, there would have been an improvement. The financial statement accompanying the report shows that the net gas-rental amounted to £17,822; residuals produced £7352; and the total receipts were £26,640. The expenditure for the manufacture of gas was £9217; for distribution, £1298; for maintenance, £1325; and for interest and sinking fund, £7554—the total being £24,515, and leaving a profit of £2125. This sum, added to the balance brought forward, made a total of £5114; and £2900 was transferred to the district fund. The cost of coal and the working expenses (less residuals) came to 14·06d., and the total gas-rental to 28·58d., per 1000 cubic feet of gas sold. The gross profit was 14·52d., and the interest and sinking fund came to 11·11d.; leaving the net profit 3·41d.

Leigh Gas Profits to Liquidate Water Deficit.—At a meeting of the Leigh Town Council this (Tuesday) evening, the following resolutions of the Gas-Works Sub-Committee will be brought forward for confirmation: "(1) That the sum of £624 be transferred from the gas fund to the credit of general district fund, to be applied in liquidating the deficit on the water undertaking at March 31, 1912. (2) That no alterations be made in the prices charged for gas."

LOUGHBOROUGH GAS UNDERTAKING.

At a Meeting of the Loughborough Town Council on Monday of last week, the statement of accounts of the Gas Department for the year to March 31 last was presented. The total expenditure was £13,792, including £10,756 on the manufacture of gas, and £1288 on distribution. The sale of gas produced £15,824, and of residual products £4064, and the total receipts were £22,101, leaving a profit balance of £8309. This, added to a balance of net profit from the last account of £478, made £8787, which met the interest on loans, sinking fund, and income-tax, amounting to £6853 and left a balance of £1934 net profit to carry forward.

In submitting the report to the Council, Alderman Bumpus said they were again faced with a very satisfactory result. The balance on the revenue account was much larger than ever before—£8309, an increase of £649 on the previous year, which was itself a very high total. The cost of production was somewhat less; the plant being worked with increasing efficiency. These good results had not been attained by any pinching of repairs and maintenance, on which they had spent £974 during the year, as compared with £804 the previous year. As a matter of fact, the plant was as efficient to-day as, even more so than, it was ever before. The consumption had increased by nearly 4 million cubic feet, and the cost of coal had been less. The increased consumption and improved financial position were largely due to the consumers who used the slot-meters, of whom there were 363 more at the end of March than a year ago; and their average consumption had also risen. It was very satisfactory to them all that the coal strike led to no curtailment of the supply, and that through the large accumulation of coal the gas-works were enabled to be of public use by supplying coke to people who were short of coal. The profit of £8309 exceeded the charges for interest and sinking fund and income-tax by £1456; and this, added to what was already standing to the credit of the undertaking, made a total of £1934. This brought them to a rather interesting point, to which attention might well be called—that the large amount which was found by the general district fund during the earlier years of the undertaking, when it did not pay its way, was now either repaid or stood to the credit of the undertaking for repayment. They received from the general district fund during those earlier years a total of £5830; and they had repaid to the fund £4500—leaving £1330 due, to meet which they had £1934 in hand. They might congratulate themselves on the working of the undertaking since the Council became responsible for it. The average profit for the last three years when it was in the hands of the Company was £3284. After twelve years, the Council had increased the profit to £8309. This had been done without any very large increase of population, through a period of decided bad trade; and there had been the more or less adverse influence of the electricity undertaking, which had certainly taken away many gas customers. During the period named, besides paying off the costs of the Act (£3040) they had paid into the sinking fund £15,667, as well as the interest on loans as they went along. This was a very satisfactory achievement, and reflected great credit on the management. He did not think they could have had—from the Manager (Mr. Edward Onions) at the top to the workers at the bottom—a more efficient and more assiduous staff; and very few undertakings in the country could point to twelve years of such successful working as these figures showed.

MARKET HARBOROUGH DISTRICT COUNCIL GAS SUPPLY.

Gas Manager's Annual Report.

At the Meeting of the Market Harborough Urban District Council last Tuesday, the report of the Gas Engineer and Manager (Mr. A. T. Harris) for the year ended the 31st of March was under consideration, in conjunction with the report of the Gas Committee. Mr. Harris furnished the following particulars.

The net receipts were £10,351, or £701 more than in the year 1910-11; the expenditure was £7214, or £590 more; and the gross profit £3137, or an increase of £111. Deducting the interest on loans and the repayment of principal—together £2095—there was left a net surplus of £1042. After providing for £318 expended on additions to plant, the balance at the credit of the profit and loss account was increased by £724, and at the close of the financial year stood at £4268. The average make of gas per ton of coal carbonized was 12,968 cubic feet, against 12,150 cubic feet before. The total make of gas was 58,500,000 cubic feet, or 2,658,000 cubic feet more than in 1910-11. The quantity sold through ordinary meters showed an increase of 1,801,600 cubic feet, and through prepayment meters of 1,140,000 cubic feet; a total increase of 2,941,600 cubic feet, or 6·15 per cent., and equal to a net cash increase of £493 18s. 10d. The receipts from coke, tar, and sulphate of ammonia all showed advances; the net receipts on the cost of coal being 68·29 per cent., against 62 73 per cent. In concluding his report, Mr. Harris said: "The past year has been the most successful yet recorded, both in respect to working and financial results. The increased make of gas and sale of coke per ton of coal carbonized are undoubtedly due to the improved results obtained from the new chamber retort setting, which has been working continuously since October last. I have also pleasure in reporting that the working of the whole of the plant and staff and workmen has been satisfactory throughout the year."

In moving the adoption of the Gas Committee's report, Mr. Douglass said the period covered by it had been another successful year; the gross profit being the largest yet recorded—viz., £3137, against £3026, and the net profit being £1042, against £933. The liability of the undertaking had been reduced by upwards of £900; and it now stood at £39,334, which was practically the same amount that the undertaking cost when it was purchased, without allowing for the fact that its value and the output of gas had increased more than 60 per cent. in the same time. The plant was in much better condition now than it was then; and, in fact, it was in as efficient a

condition as it could possibly be. There was an increase of 2,941,600 cubic feet in the quantity of gas sold, which was a record. The gas made per ton of coal carbonized was 12,698 cubic feet; and the actual sales were 12,020 cubic feet. This was far in advance of any previous year, and compared favourably with any similar concern in the country. In conclusion, he should like to say, on his own behalf and on that of the Committee, they thought Mr. Harris was to be much congratulated on the very successful result he had achieved; and he considered their best thanks were due to the other members of the staff for the loyal co-operation they gave to the department. Mr. Gardiner endorsed all Mr. Douglass had said. The Chairman (Mr. G. J. Thwaites) pointed out that the additional quantity of gas produced per ton of coal was due entirely to the better plant they had, and not to better coal. This proved, he said, that they were keeping the machinery in good condition.

The report was adopted.

SIR J. HAWTREY COX AND THE EATON GROUP.

In the "JOURNAL" for the 7th ult. (p. 346), some comments were made upon a prospectus of a Brighton Mineral Water Company which was being widely circulated, and which bore indications that the Company was one of the notorious Eaton group. In the course of the comments, reference was made to the fact that Sir J. Hawtrey Cox, Bart., was one of the Directors. Shortly afterwards, this gentleman's name was mentioned in "Truth," in an article headed "The Eatonesque Brand," criticizing the issue of a circular and imitation prospectus of Suddine, Limited. Sir J. Hawtrey Cox has addressed a letter (dated the 3rd inst.) on the subject to our contemporary, and it appears in the current issue. In the course of it he makes the following remarks, explanatory of his position.

I resigned my seat on the Board of Suddine, Limited, last week, after having threatened to do so, and sever my connection with Mr. Eaton and his undertakings, on May 14 and 17 last, as I could not reconcile my business ideas to those of Mr. Eaton and his friends.

It was the extraordinary business methods of one of Mr. Eaton's rotten little gas companies, as you call them, that first brought home to me the class of person Mr. Eaton was. He was introduced to me by Colonel John Austen Carpenter, of 15, Belsize Crescent, Hampstead, for the express purpose of going on the Board of Suddine, Limited, when he stated that Mr. Eaton and his friends were reliable persons, with considerable capital behind them. This I now know was not a fact.

My seat on the Brighton, Eastbourne, and Bognor Crystal Water Company, Limited, I propose to retain for the present, in the hope that I may be the means of recovering for the subscribers the moneys paid for shares which have been applied for and allotted without my knowledge or consent since the 7th ult. This matter being settled, I propose having nothing further to do with Mr. Eaton or his group.

THE LATE GAS ENGINEER AT WIGAN.

Tribute by the Borough Council.

At the Meeting of the Wigan County Borough Council on Wednesday last, sympathetic reference was made to the recent death of Mr. Joseph Timmins, the Gas Engineer and Manager.

The MAYOR (Alderman T. Ashton) said that before commencing the business of the Council they ought to refer to the lamented death of their Gas Engineer. Though the Gas Committee passed a resolution of condolence with the family, they as a Council ought to pass a vote of sympathy, and say how sorry they were to hear of Mr. Timmins' death. They desired to recognize the great services he had rendered to the town for a quarter-of-a-century, which were appreciated by the governing body of the town. He was a good and faithful servant to the Corporation and to the town; and it now became his melancholy duty to move the following motion: "That this Council, having heard with profound sorrow of the death of Mr. Joseph Timmins, desire to place on record their appreciation of the valuable service he rendered to the borough as Gas Engineer and Manager during the period of twenty-five years, and beg to tender their sympathy and condolence with his widow and family in their sad bereavement."

Mr. M'QUAID, who seconded, said he agreed with every word the Mayor had said. He had known Mr. Timmins during the whole of the twenty-five years he had been in Wigan; and he had never known a better public servant. He was attentive to his duties and courteous, and possessed every qualification that went to make up a real, true servant of the public. Not only did the Council regret his death, but there was the same feeling outside. All they could do now was what the Mayor had proposed—record their deep regret, and condole with the widow and family.

The motion was carried in silence by the members standing.

SALES OF STOCKS AND SHARES.

The important sale conducted by Messrs. A. & W. Richards at the Mart, Tokenhouse Yard, last Tuesday, included only one new issue of capital—viz., by the Directors of the Barnet District Gas and Water Company, who had £10,000 of "D" water stock for disposal. It ranks for a maximum dividend of 7 per cent., and similar stock is receiving £5 12s. per cent. It was all placed at £117 to £121 5s. per £100. The following sales were by order of executors: A few fully-paid original £10 shares in the Ascot District Gas and Electricity Company, ranking for a maximum dividend of 10 per cent., and carrying 5½ per cent., fetched £11 10s. to £12 each. Some £10 shares in the Whitchurch and District Gas Company, Limited, carrying 5 per cent. dividend, were sold for £9 apiece. A parcel of £1 shares in

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fitted to the "SUN" Boiler controls the apparatus, and ensures that not a foot of gas is used beyond what is actually needed to maintain the water at the right temperature.

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in its action, this Valve exercises greater vigilance over the gas supply than is possible with the most watchful and economical of human attendants. The exceptional economy of gas consumption thus effected, combined with the general efficiency of the apparatus, has resulted in the "SUN" being widely adopted in all classes of households as well as in schools, public institutions, &c., throughout the country.

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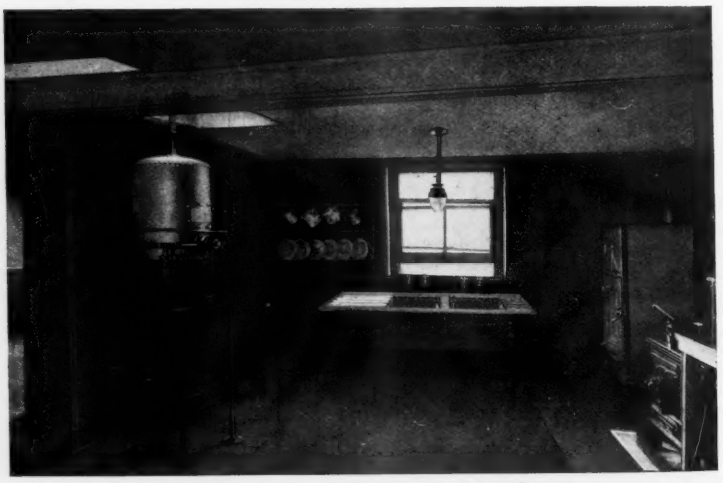

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A REMARKABLE PROOF OF THEIR EFFICIENCY.

89

the Hungerford Gas Company, Limited, also carrying 5 per cent., realized 19s. per share. "A" stock (5 per cent.) of the Bromley and Crays Gas Company, carrying 6 per cent., fetched £133 10s. per £100; and "B" stock (3½ per cent., but receiving 4½ per cent.), £102 5s. A few £10 shares in the Soham and District Gas Company, Limited, carrying 5 per cent., realized £9 each. Small quantities of "A" and "B" stocks of the Croydon Gas Company, carrying 15 and 12 per cent. dividends respectively, were sold at the rate of £316 10s. and £255 10s. per £100 of stock. Under instructions from the same executors and another owner, a few £10 original shares in the Brixham Gas Company, carrying 10 per cent., were sold for £20 each; and four shares of the same nominal value, but bearing only 7 per cent. dividend, fetched £14 apiece. On the same occasion, some consolidated ordinary stock of the Mitcham and Wimbledon District Gas Company, ranking for a standard dividend of 5 per cent., but carrying 5¾ per cent., fetched £130 to £130 10s. per £100.

Last Tuesday, by instructions of the Directors, Mr. E. H. Cooper sold 2000 fully-paid £5 (5 per cent.) shares in the Portsmouth Water-Works Company. The whole of the shares were speedily disposed of at prices ranging from £6 5s. to £6 10s. each; the amount realized being £12,573 2s. 6d. In accordance with an announcement which recently appeared in our advertisement columns, Messrs. John E. Pritchard and Co. sold by auction at Bristol, last Thursday, £15,000 of 7 cent. maximum consolidated ordinary stock of the Bristol Water Company in lots of £100 and upwards, at the reserved price of £134 per £100 of stock. The prices obtained averaged £135 16s. 8d. per £100; and the total amount realized by the sale was £20,375.

NOTTINGHAM CORPORATION WATER SUPPLY.

Progress of the Undertaking—Participation in the Derwent Scheme.

At the Meeting of the Nottingham City Council on Monday last week, the report presented by the Water Committee contained that of the Engineer and General Manager (Mr. F. W. Davies). In the course of it, he stated that the total quantity of water pumped from all the works during the year ended March 31 last amounted to 2,987,443,205 gallons; the average weekly quantity raised being 56,366,853 gallons, or equal to an average of 8,052,407 gallons per day. The maximum weekly quantity of water pumped during the summer was 71,239,051 gallons; and during the winter, 61,043,194 gallons. The total storage capacity of the various reservoirs is 13,845,058 gallons. In their report, the Committee said their ideal was to increase the profit on the undertaking to £25,000, the amount of their obligation to the Derwent Valley Water Board as from the beginning of the present year. In 1910-11, there was a gratifying advance towards the desired result; the profit being increased to £21,000. For the past financial year, a profit of £24,618 was recorded. Attention was again drawn to the fact that the additional profits had not been secured entirely by means of increased charges to consumers; no general advance having been made. Many minor adjustments to scale had, however, been made by the re-organized Assessor's Department.

In addition to the amount required by the Water Board as Nottingham's share of the joint capital outlay, the Committee are under obligations in regard to about 7½ miles of pipe-line between the Ambergate service reservoir and the boundary of the Nottingham water area at Langley Mill. Under the several Acts, this pipe-line has to be maintained by the Board at the expense of the Corporation of Nottingham; and as a portion of the district through which the line passes is subject to colliery operations, the cost of maintenance will, it is considered, probably add materially to the working costs of the undertaking. The Derwent water is not yet available; but it is hoped that it will be received some time during the current year. Meanwhile, the necessary mains are being laid to convey the supply from Langley Mill to the Ramsdale service reservoir.

FUTURE WATER SUPPLY OF LONDON.

Proposed New Reservoirs.

In the last number of the "JOURNAL" (p. 662), it was mentioned that the Finance Committee of the Metropolitan Water Board have had under consideration an important report by the Works and Stores Committee, furnishing details of a scheme for the construction of additional reservoirs. The Committee propose that the reservoirs should be dealt with in three sections, and that the construction of the first should be commenced as soon as possible. The sections may be summarized as follows:

First Section.—Reservoir No. 7 (3500 million gallons) and pumping-station at Littleton; intake works at Laleham just below Penton Hook; conduit to the reservoirs; 15 acres of filter-beds at Kempton, with a small covered reservoir for the filtered water, and pumping machinery at Kempton capable of delivering not less than 30 million gallons a day into the high-level service reservoir. A steel aqueduct from Kempton to Shoot-up Hill, about 15 miles in length, with connections to the high-level service reservoir, Cricklewood, Willesden, and Ealing, and a high-level service reservoir with a capacity of (say) 20 to 25 million gallons. The works comprised in this section should, the Chief Engineer advises, be ready for use by the end of 1917.

Second Section.—Reservoir No. 6 (3500 million gallons) at Littleton.

Third Section.—Reservoir No. 5 (3300 million gallons) at Stanwell, with inlet works and outlets to the existing Staines aqueduct; filter-beds of about 25 acres at Kempton; and additional pumps for filtered water and centrifugal pumps for filling the reservoir.

The cost of the whole scheme, with due reservation for further consideration, the Committee think may be foreshadowed as follows:

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56, Broad Street, BIRMINGHAM; 13, Whitworth Street West, MANCHESTER; Gothic Ironworks, FALKIRK; 136, Renfield Street, GLASGOW; 83, Old Market Street, BRISTOL; 8, Exchange Place, Donegall Street, BELFAST; 333, Queen Street, MELBOURNE; and 12, Cunningham Lane, Pitt Street, SYDNEY, N.S.W.

First section, £1,646,400; second section, £635,000; third section, £950,500; and mains and connections, £250,000—total, £3,481,900. These figures are not, however, submitted as a formal estimate, but are only put forward as an attempt to forecast the financial aspect of the matter.

As previously stated, the scheme refers only to the supply of water north of the Thames. The Committee have had before them proposals by the Chief Engineer and the Deputy Chief Engineer for improving and safeguarding the supply on the south side of the river, and have asked them to consider further this aspect of the subject. For the present, therefore, they defer a report upon it; but they indicate that the works involved will not be nearly so extensive as those outlined above for the purposes of the northern district. Indeed, on a generous estimate, their cost will not, so far as they can see, exceed (say) £350,000. The extent of the works in some measure depends upon whether or not the existing supply to Chelsea is transferred to the southern district; the intakes, reservoirs, filter-beds, pumping-stations, and elevated service reservoirs of the Chelsea supply being all within that district. The scheme the Committee recommend for the northern district is based upon the assumption that the Chelsea supply will be so transferred. If such a transfer should not be effected, it would presumably reduce the quantity of additional water to be pumped on the north of the Thames, and increase that to be pumped on the south. These, however, are matters of detail upon which the Committee cannot express any definite views pending the further reports which they are awaiting from the Engineers.

The report concludes with the following recommendations:

(*a*) That, subject to approval of the plans, estimates, and tenders mentioned in the next recommendation, the construction of reservoirs Nos. 6 and 7, authorized by the Metropolitan Water Board (New Works) Act, 1911, be undertaken by the Board.

(*b*) That the Works and Stores Committee be instructed to provide, for consideration by the Board, a full report, plans, estimates of cost, and tenders for the construction of Reservoir No. 7, at Littleton, and the necessary works for intake, filtration, and distribution purposes, north of the Thames, as proposed in their report of May 8, 1912.

(*c*) That it be referred to the Law and Parliamentary Committee to report as to whether any, and what, additional powers are required for the purpose of giving effect to the foregoing resolutions.

Forthcoming Sale of Gas and Water Stocks.—It is announced that on Tuesday next, the 18th inst., Messrs. A. & W. Richards will have a sale by auction, at the Mart, Tokenhouse Yard, E.C., of various gas and water stocks and shares. The lots include two new issues of gas capital (for the Southgate and District and Grays and Tilbury Companies), two new issues of water capital (for the South West Suburban and the Great Yarmouth Companies), as well as some Christchurch gas shares.

NOTES FROM SCOTLAND.

From Our Own Correspondents.

Saturday.

The ninety-sixth meeting of the Waverley Association of Gas Managers in Edinburgh, a report of which appears elsewhere, was a great success, and bore out the oft-repeated remark that this venerable body is renewing its youth. The growth in membership, which has been the characteristic for several years past, is being maintained; and the indications are that the incoming year will show a further improvement in this desirable direction. The various officials have each and all of them started off with the intention of still further increasing the usefulness and range of influence of the Association; and the hope is that their efforts will be crowned with success. One very gratifying feature of the meeting was the keenness with which Mr. Napier's suggestion regarding Commercial Sections was fixed upon; and it is probable that something will be done in this matter. It only remains to be said that the gathering was a large one, the discussion was conducted with critical acumen, and altogether it was very stimulating and hopeful in its auguries so far as future development is concerned.

On Saturday next the members of the Eastern District of the Scottish Junior Gas Association will pay a visit to the works of Messrs. James Milne and Son, Edinburgh.

Among the registrations of joint stock companies in the Exchequer Office, Edinburgh, this week is the Thurso and North of Scotland Gas Corporation, to acquire and carry on the business of gas manufacturers and suppliers now conducted by Robert Porter, of Riversdale, York, at Thurso, Caithness, under the style of "The Thurso Gas Company." The capital is £15,000, in £1 shares.

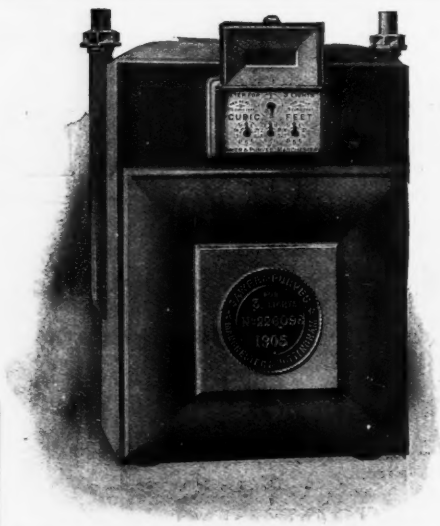
Aberfeldy.—At the annual general meeting of the shareholders of the Aberfeldy Gaslight Company, it was decided to pay a dividend at the rate of 4 per cent. on July 1.

Blairgowrie.—The Blairgowrie Gaslight Company will for the coming year have to pay over £150 more for coal than last year.

Cambuslang.—A dividend of 6 per cent., free of tax (making 10 per cent. for the year), was declared at the annual meeting of the Cambuslang Gas Company on Wednesday. This will absorb £2160. The sum of £600 was written off for depreciation, and £190 carried forward. It was agreed to raise the Directors' fees to £150.

Darvel.—On the minutes of the Gas Committee coming up for confirmation at the monthly meeting of the Burgh Commission, Councillor Cleland, jun., took exception to the recommendation of the Committee not to grant slot meters in the case of three applicants. One of these had a gas-cooker, and the quantity of gas used amounted to a considerable sum monthly, which, if paid by slot meter, would not be so difficult to meet. Councillor Reid was of opinion that those who had slot meters paid more for their gas, and he could not see why it was better for the consumer to buy gas through a slot meter and thus pay more.

DRY GAS METERS.



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The Gas Committee had installed these meters in cases where the consumers would not pay in any other way. A motion that the Gas Manager be empowered to supply slot meters to the extent of 25 per annum was defeated; and it was agreed to continue the present arrangement.

Helensburgh.—At the Town Council meeting on Friday, the Gas Convener submitted a report on the new gas-works, which showed that during the past year they had carbonized 365 tons of coal less than the previous year; while at the same time, as the result of the new plant, they had obtained 8,309,000 cubic feet more gas.

Kilmarnock.—Mr. Alexander M'Graw, the oldest employee of the Corporation, died on the 29th ult. He had been in service at the gas-works for over forty years, and retired about a couple of months ago on a pension.

Kirkcaldy.—Chief Constable Gatherum, in a report to the Streets Committee of the Kirkcaldy Town Council, states that there are now 1115 gas-lamps within the burgh; being eleven more than the previous year. There are 966 lamps fitted with incandescent burners, and 119 with ordinary flat-flame burners. The sum paid for gas consumed was £946 16s. 1d.—an increase of £89 13s. 4d. on the previous year. The average number of mantles used per lamp during the season was 6·56, compared with 6·50 last year. He states that he experimented with inverted burners in St. Clair Street during the year, but found the upright burner to be far more satisfactory.

Leven.—The report of the Directors of the Gas Company tells of a most prosperous year. Dealing with the whole works, the Directors say that the balance on the profit and loss account, after providing for depreciation, amounts to £3024: and they recommend that the sum of £1350 be set apart for the payment of a dividend of 7½ per cent., free of income-tax; that £450 be paid as a bonus of 2½ per cent.; that £500 be placed to the reserve account; and that the balance of £724 be carried forward to the credit of the succeeding year.

Peterhead.—The monthly meeting of the Town Council was held on Monday, when several important matters arose from the minutes, especially those of the Gas Committee. It was reported at a meeting of the Committee named that, on the day of the annual stocktaking, a rumour, emanating from one of the employees at the gas-works, was abroad, to the effect that certain carboys supposed to contain sulphuric acid were really filled with water. Accompanied by Bailie Dickie, Mr. Martin, the Convener, had gone to the gas-works and had the contents of the carboys tested, and found that the statement was entirely without foundation. The Gas Committee met again on May 28—that being the first occasion on which Mr. Alexander Davidson had attended the meeting in his official capacity as Gas Treasurer. On the recommendation of the Manager, it was resolved to lay a 3-inch pipe the whole length of Hope Street before the roadway is formed.

The annual conference of the Institution of Heating and Ventilating Engineers will be held at Southport from the 24th to the 29th inst. Permission to inspect the gas-works during the visit has been granted by the Gas Committee.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 8.

Sulphate of Ammonia.

With the covering of May contracts, demand fell off; there being no hurry about those for June shipment, and home demand being at an end. Consequently larger available supplies have come into sight, and these have only been disposed of at declining prices. The closing quotations are £14 12s. 6d. per ton f.o.b. Hull, £14 13s. 9d. per ton f.o.b. Liverpool, and £14 15s. per ton f.o.b. Leith. There is not much change in the forward position. It is reported that £14 12s. 6d. per ton has been paid for a twelve months' contract; but at the close there are sellers at this price in any position up to June, 1913, without much keenness on the part of buyers.

Nitrate of Soda.

There is no change to report in this article; the quotations remaining 11s. per cwt. for 95 per cent., and 11s. 1½d. for refined quality.

LONDON, *June* 10.

Tar Products.

There is little alteration in the markets for tar products, though on the whole prices remain firm. There is a steady demand for pitch; but consumers are reluctant to pay the prices asked at the moment. Small lots are being sold for prompt delivery at exceedingly good figures. Benzols are firm for near delivery; but business is difficult for forward, owing to the high prices which are being asked. Solvent naphthas are steady and in good demand. Heavy naphthas maintain their price; and there is a fair amount of inquiry for both prompt and forward delivery. Crude carbolic is without change.

The average values during the week were: Tar, 28s. to 32s. *ex* works. Pitch, London, 53s. to 54s. 6d.; east coast, 52s. 6d. to 54s.; west coast, Clyde 53s. to 54s. 6d., Manchester 51s to 53s. 6d., Liverpool 52s. 6d. to 53s. 6d. Benzol, 90 per cent., naked, London, 11d. to 11⅛d.; North, 11d.; 50 90 per cent., naked, London, 10d.; North, 9½d. Toluol, naked, London, 10½d.; North, 10d. Crude naphtha, in bulk, London, 4⅜d. to 5⅛d.; North, 4d. to 4⅜d. Solvent naphtha, naked, London, 1s. 1d. to 1s. 1½d. f.o.b.; North, 11½d. to 1s. f.o.b. Heavy naphtha, naked, London, 11d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 2⅞d. to 3⅛d.; North, salty, 2⅜d. to 2⅝d.; liquid, 2⅝d. to 2¾d. Heavy oils, in bulk, 3¼d. to 3⅜d. Carbolic acid, casks included, 60 per cent., east and west coast, 2s. 4d. to 2s. 5d. Naphthalene, £4 10s. to £10; salts, 45s., bags included. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

Towards the close, there was a decline to the extent of about 2s. 6d. per ton at nearly all ports with the exception of Liverpool; and deliveries in this quarter seem to be so much behind that at the

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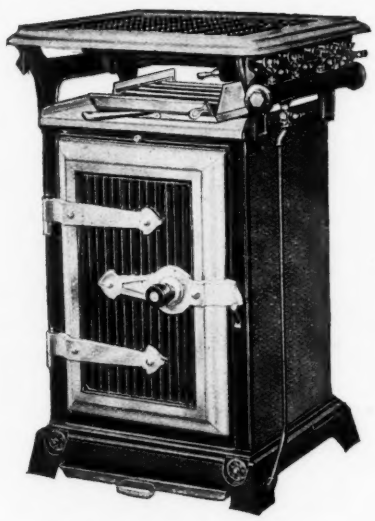

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moment quotations are higher than elsewhere. Actual Beckton is still quoted at £14 5s., though outside London makes could be purchased at £13 17s. 6d. The price at Hull is £14 13s. 9d.; Liverpool, £14 16s. 3d.; Leith, £14 15s. to £14 16s. 3d.; Middlesbrough, £14 15s.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade is quieter, and coal that would have been sent to the Metropolis has been put on to the market; so that prices are easier. In the steam coal trade, best Northumbrians are about 12s. 6d. per ton f.o.b.; second-class steams are about 11s. per ton; and steam smalls are steady at 9s. to 9s. 6d. The production is fairly well maintained, and is taken up generally steadily. The gas coal trade is fairly active for this season of the year, and the prices are steady. Best Durhams are about 13s. 6d. per ton f.o.b.; second-class gas coals are near 11s. 6d.; and "Wear" specials are about 14s. 6d. A number of contracts for Continental gas-works have been decided, and include 12,000 tons for Riga at about 14s. per ton f.o.b., 5000 tons for Gefle, over the season, at a like price, and 15,000 tons, special quality, for the Norrkjöping Gas-Works, at 13s. 9d. to 14s. per ton f.o.b. Some larger contracts for home gas-works are in the market, and will be probably settled in the course of a few days; and it is tolerably clear that such contracts will show a considerable increase on those that they succeed. Coke is firm. Gas coke, despite the lower output, is easier. Prices of good gas coke are about 15s. per ton at the works; while 17s. 9d. to 18s. per ton represents the f.o.b. quotation at present.

Scotch Coal Trade.

The tone of the Scotch coal trade has been steadier during the week; but there has not been much improvement either in respect of demand or in prices. On Friday prices were: Steam coal, 10s. 3d. to 10s. 9d. per ton f.o.b. Glasgow; splint, 11s. to 11s. 6d.; ell, 10s. 6d. to 10s. 9d.; trebles, 10s. 3d. to 10s. 9d.; doubles, 10s. to 10s. 9d.; and singles, 10s. 9d. to 11s. 3d. In Fife and the Lothians, there has been a rather increased export trade, done at slightly firmer prices.

Gas-Coal Contracts.

On Wednesday last, the "Financial Times" inserted the following remarks from a correspondent: "Contracts for gas fuels are mostly arranged from July 1 for twelve months, and usually by this time a heavy tonnage has been fixed up. This year, however, chiefly owing to the late strike, and to the certainty that substantial advances would be quoted for renewals to cover the increased costs of production incurred by recent legislation, many of the large gas concerns have not yet asked for tenders. Nevertheless, 'feelers' are being thrown out, to ascertain the terms upon which collieries will renew contracts. It is generally understood that 2s. 6d. per ton on coals and 3s. per ton on gas nuts are the advances that collieries will hold out for; and several small-tonnage contracts have already been renewed on these terms. It may be remembered that last year contracts were renewed at reductions of 3d. and 6d. per ton; but owing to the strike this year, stocks were brought down to very low levels, and some works have bought supplies on the open market at much higher prices than their contracts to increase stocks."

Stockport Corporation Gas Profits.—Another record has been established by the Gas Department of the Stockport Corporation. On the past financial year's working there was a gross profit of £47,315, and a net profit of £26,657, compared with £45,933 and £26,192 respectively for the previous twelve months. Within comparatively recent times the net profit on the gas undertaking has increased from £10,000 to more than £26,000, each succeeding year showing an improvement on the last. For 1910-11 the income was up by nearly £6300, showing an increase of 5½ per cent. on the previous twelve months. But for labour troubles, the past year's working would have shown an even better result than has been declared; and Mr. S. Meunier, the Gas Engineer, has been congratulated upon having achieved another record despite the drawbacks.

The Supply of Gas to Disley.—It was resolved at the monthly meeting of the New Mills Urban District Council that application be made to the Local Government Board for sanction to borrow £10,000 for gas purposes. It was explained that the money was required chiefly for an extension of the mains to Disley and other parts of the district. The Clerk to the Council reported that the Local Government Board had approved of the Provisional Order authorizing the Council to supply gas to Disley, and were sending it forward to Parliament. The Order, the Clerk added, was substantially the same as submitted at the last meeting of the Council, except that present consumers in Disley parish were not to count in the total consumption for the differential rate. The Order was approved, and the Law Agents of the Council were left to deal with the clauses desired by the Cheshire County Council and the Midland Railway Company.

Manchester Corporation and the National Insurance Act.—The Special Committee of the Manchester City Council appointed to consider the National Insurance Act and its application to workers in the employ of the Corporation, decided at a meeting held on Friday last that steps should not be taken as to the formation of a separate "approved society" for Manchester Corporation employees. Twelve members of the Council were recommended for appointment as representatives on the Manchester Insurance Committee; being one-fifth of the total number. The members of the Manchester Municipal Employees' Guild met last Friday night to discuss their position under the Insurance Act. After a full discussion, it was unanimously resolved that application should be made for exemption. All the Town Hall employees are contributors to the thrift fund; but it is not clear whether this will be recognized by the Commissioners as sufficient.

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Birkenhead Gas-Works Extensions.

As a further instalment of the works comprised in the Birkenhead Gas-Works Extension Scheme, sanctioned on Oct. 28, 1908, and in respect of which formal application was then made for borrowing powers for £114,000, the Corporation are proposing to extend the manufacturing plant at the central works by installing vertical retorts. The tender of the Woodall-Duckham Vertical Retort and Oven Construction Company has been accepted for the construction and installation of Woodall-Duckham vertical retorts capable of carbonizing 200 tons of coal per 24 hours; the price being £31,421. Application is to be made to the Local Government Board for sanction to a loan to cover the expenditure. In supporting the acceptance of the tender at the meeting of the Town Council last Wednesday, Alderman M'Gaul (the Chairman of the Gas Committee) said the new system would be a great saving to the Gas Department. The profit on the undertaking for the year was £49,000; and after paying certain charges, there was a balance of £29,500 to be divided between the borough fund and the renewals fund. Another instalment of the extension scheme already embarked upon is the laying out of a complete storage station, with a four-lift holder and tank, at the Laird Street site, in the north end of the town.

Blackpool Gas Finance.

Alderman Heap, the Chairman of the Blackpool Finance Committee, in the course of his annual financial statement, given at a meeting of the Town Council last week, stated that all the Committees had kept within their estimates during the past year. In addition, each department had handed over more than was estimated in relief of rates, with the result that there was a balance on the right side of £12,191; and as the trading concerns of the Corporation had produced £4682 more than was estimated, the Corporation had in hand altogether a balance of £16,873. The Gas Department, for example, had estimated their profits for the year ending March last at £12,700, whereas there was a total of £14,700. Last year they took £21,670 from revenue-earning departments towards the relief of rates; but for the current financial year it was only proposed to take £10,970. There were many new items to face, making a total of £24,576 altogether; this including £1200 for the installation of new incandescent lamps on the promenade, and £1300 for an increase in the wages of the workmen employed by the Corporation. In addition, they had to face what they had not had to face for many years—a decrease in gas profits by £6300, due to the coal strike and the increase in the price of coal. He thought, however, that the Chairman of the Gas Committee would agree with him when he said that the estimated increase of 2s. 6d. per ton for coal was a rather large one. At any rate, they all hoped that this estimated increase would be found to be well above the mark, as the Finance Committee were looking for much greater help from the Gas Department than was foreshadowed in the estimates of the Gas Committee.

Bury Corporation and Gas Profits.

As briefly stated in last week's issue (p. 664), the past year's working of the Bury Corporation Gas Department showed a net profit of £9588, out of which the Committee decided to place £853 to reserve fund, leaving a balance of £8735, which was divided equally between the general rate and the gas consumers. At the Council meeting last Thursday, Mr. S. Kay (the Chairman of the Gas Committee) supplied further particulars of the department's successful year. The report of the Engineer, he said, showed a large increase in the demand for gas for lighting, heating, and cooking; the gas consumed being 14½ million cubic feet more than in the previous twelve months. In the period under notice, 204 additional cookers, 798 new grillers, and 383 gas-boilers had been fixed. The price of gas was now 1s. 11d. net per 1000 cubic feet. For motive power and manufacturing purposes, an extra discount of 2d., 4d., and 6d. was allowed off the above price, according to the quantity used. Consumers in the added areas had to pay 9d. above these prices; and he expressed the hope that during the coming year the so-called "added areas" would be incorporated with the borough, and the inhabitants thus get the advantage of having their gas at the same price as now paid in the borough. Alderman Ashworth said there seemed to be a disposition on the part of certain members to lose sight of the fact that the "disposable profit" of £8735 had been drawn out of the pockets of the consumers of gas. Yet half was to go for the benefit of the ratepayers, who might be small gas consumers but large ratepayers. This was an arrangement which was not fair. Alderman Greenhalg also believed in the policy of selling gas practically at cost price, and thought the time had come for them to seek an amendment to the Act under which one-half of the net profits on the undertaking went to the ratepayers and the other half to the consumers. In reply, Mr. Kay expressed the opinion that they should try to make their municipal undertakings profitable. He instanced the loss on the Water Department, and said if they condemned profits being made, he would like to know how they were going to pay their debts on other concerns that were losing. He thought the profit made on the gas undertaking was a reasonable one. In nine cases out of ten the consumers of gas practically got the whole of the profits back, if not in a reduction in the price of gas, certainly as ratepayers. The minutes and report were approved.

Gas Fatality at Liverpool.—A verdict of "Accidental death" was returned by a Coroner's Jury at Liverpool, who inquired into the circumstances attending the death of Lucy Byrne, a domestic servant, sixteen years of age, who was found dead in her bedroom, which was full of gas. The girl had been told not to light the gas; and to prevent it being readily turned on, her employer had some time previously screwed the tap very tight. There was no fire-place in the room. The suggestion was that deceased had succeeded in turning on the tap, and being unable afterwards to turn it off again had left the unlighted gas to escape.

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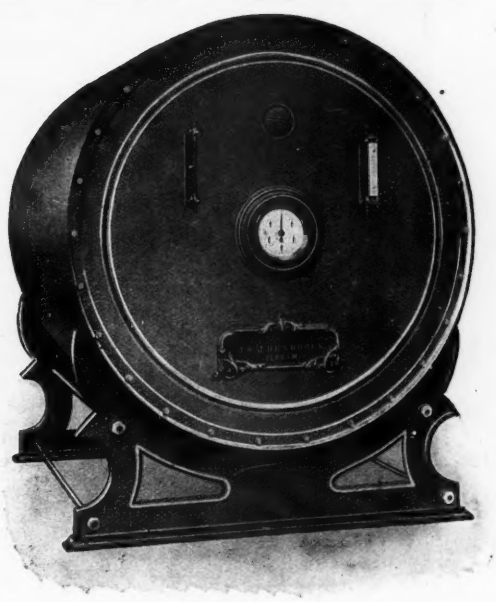

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Hard Labour for Stealing Gas.

Proceedings were taken by the British Gaslight Company at Hull, last Wednesday, against William Mack, a cycle repairer, for laying a pipe to a gas-main in his premises and stealing a quantity of gas. Mr. Laverack, the prosecuting Solicitor, stated that the defendant's shop was visited on May 14; and it was found by the inspector that the meter registered the same consumption of gas as on March 30 last. On making further investigations, it was discovered that the meter was disconnected from the Company's main, and that a pipe had been fitted from the main direct to the defendant's shop. The defendant, Mr. Laverack added, had no doubt used gas from March 30 to May 14 in this way. After hearing the evidence, which bore out this statement, the Stipendiary Magistrate sentenced the defendant to two months' imprisonment with hard labour—remarking, as he did so, that a more barefaced and impudent fraud it was difficult to imagine.

Action Against the Weald District Gas Company, Limited.

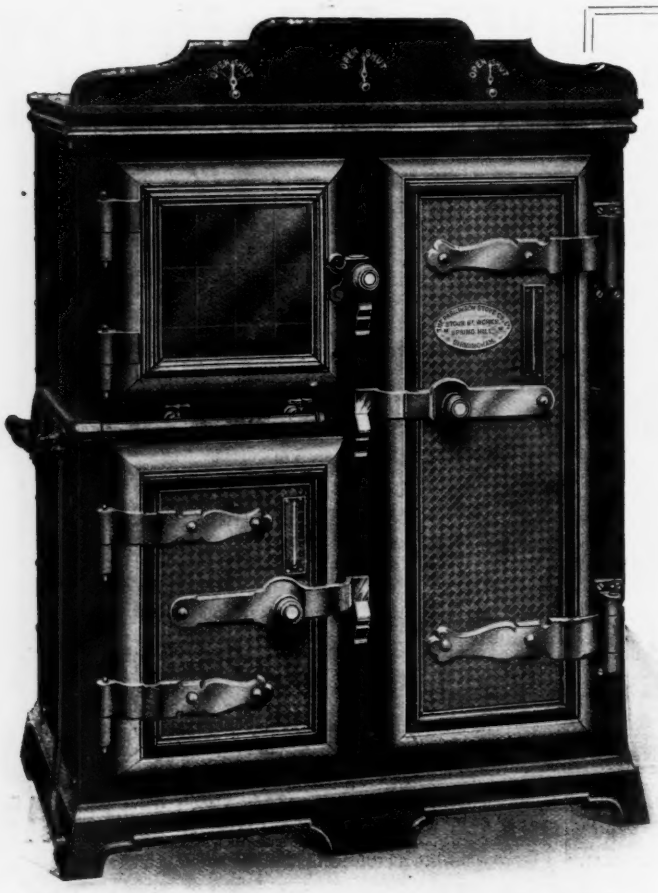
The case of *Myers, Rose, and Co., Limited, v. Weald District Gas Company, Limited*, which came before Mr. Justice Pickford, in the King's Bench Division, last Wednesday, was brought by a firm of coal merchants to recover from the Company, who carry on business at Battle, in Sussex, £108, being the price of 58 tons of coal supplied during the recent miners' strike. Mr. Wootten, who appeared for the plaintiffs, said there was no appearance by the defendants, though they had put in an affidavit raising a defence of warranty and breach. He did not know whether a little note which appeared about the Company in a financial paper that morning explained matters, where it was stated that defendants were issuing a queer little prospectus. It was possible they were too much occupied by their financial operations to be present. Mr. Herbert Holt, coal salesman for the plaintiffs, was called, and proved that the amount was due. He said that when the defendants were written to they replied that their man who settled accounts had been ordered a rest by his medical adviser, and would be away for about ten days, and that on his return the letter would be given to him; but it was rather doubtful whether the plaintiffs would get the amount until the end of the month, which was the settling-day of the Company. The amount had not yet been paid. His Lordship entered judgment for the plaintiffs for the amount claimed, with costs.

Gas and Electricity at Bangor.—The Bangor City Council have had submitted to them the report of the Borough Engineer (Mr. Price F. White) on the working of the Gas and Electricity Departments for the year to March last. On the gas-works there was a profit of £1130; but there was a deficit of £510 for the year on the electric light works, which was stated to be largely due to the use of improved lamps, the average income from which had decreased from 5s. 4d. in 1906 to 3s. 7d. per lamp last year.

Allocation of Profits at Middleton.

The minutes of the Middleton Gas Committee, submitted for confirmation at the Town Council meeting last Wednesday, contained the annual report on the working of the gas undertaking, extracts from which were given in the "JOURNAL" for May 14 (p. 463). Mr. W. Wood, in complimenting the Gas Committee on the results achieved, said he wished to make a suggestion to them. Now that a substantial profit had been made, the question was what to do with it. For himself, he altogether disagreed with the way in which these profits had been allocated during the last few years. He had three suggestions to make to the Gas Committee. In the first place, all gas used for municipal purposes should be supplied at cost price, and not at a profit. He did not see any common sense in charging themselves for a profit, and then paying income-tax on it. In the second place, he suggested that the gas-works should pay their full share of the rates. This, of course, was a matter for the Assessment Committee. Then, in the third place, he suggested that the undertaking should pay at least 3½ per cent. on the capital to the shareholders—otherwise the ratepayers who had provided the capital. Further, that after this provision had been made the Committee should fix the price of gas as fairly as possible for the consumers. By this means the rates would be helped, and they would be doing their duty to the present generation. He did not see why they should be paying the share of future generations, as was the case now under the system whereby one-half of the net profit was allocated to the sinking fund. Mr. A. Parker, the Chairman of the Gas Committee, agreed that something might be done in the way suggested by Mr. Wood, especially in regard to the supply of gas for street lighting at cost price. At the same time, he reminded the Council that recently they had reduced the price of gas 3d. per 1000 cubic feet, and suggested that they should have twelve months' working at the reduction, at the end of which time the Gas Committee might be able to do something. The Mayor having expressed the opinion that the Gas Committee might with advantage take into consideration the points raised by Mr. Wood, the minutes were confirmed.

Devonport Gas-Works Profit.—At the meeting of the Devonport Gas Committee last Tuesday, the financial statement for the year ended March 31 was produced by the Borough Treasurer (Mr. Hoare). The quantity of gas sold was 388,983,000 cubic feet—the largest on record. The gross profit was £20,664; and after deducting interest and sinking fund charges, there was a net profit of £1645. It was pointed out by the Chairman (Alderman Tozer) that last year the price of gas was reduced by 2d. per 1000 cubic feet, and the rental of stoves reduced by 50 per cent. These concessions represented an income of £2445. In addition to this, the undertaking had been put to an expense of £700 through the coal strike; and they had spent out of revenue £1044 on renewal of mains and services. The Committee considered the result of the year's working satisfactory. It was decided to transfer the net profit to the reserve fund, which now amounts to £10,367.



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Alexandria Water Company, Limited.—The Directors of this Company, in their report for the year ended March 31, state that the total receipts amounted to £131,238—an increase of £6269; while the working expenses showed an increase of £2997. They have written off £10,764 for depreciation on machinery, filters, mains, and ice-works; making, with the amount already written off, a total of £77,444. The balance of the profit and loss account, after deducting the interim dividend of 2½ per cent. paid in December, is £69,000. From this has to be deducted a dividend of 7½ per cent. to complete the 10 per cent. on the capital; leaving a balance of £24,000, of which one half is due to the Municipality, and the other half to the shareholders. The Directors recommend the latter to fix the final dividend at 9s. 6d. per share; making, with the interim dividend, a total of 12s. for the year.

Lighting of Cobham.—The Cobham Parish Council have had before them the following estimate from the Gas Company for connecting the mains with the existing lamp-standards and for lighting the streets with gas under a five years' contract: (*a*) Lighting the lamps from Sept. 1 to March 31, one hour after sunset to 11 p.m.—Incandescent upright burners of 100-candle power, 1s. 11d. per lamp per week; or providing 120-candle power inverted burners, 2s. 1d. per week. (*b*) Lighting the lamps from Sept. 1 to April 30—1s. 10d. and 2s. respectively. (*c*) Lighting the lamps from Sept. 1 to March 31 until midnight—2s. and 2s. 2d. respectively. (*d*) Lighting the lamps from Sept. 1 to April 30 until midnight—1s. 11d. and 2s. 1d. respectively. The Company also undertook to light lamps with oil where gas-mains did not exist, at the same rate. If the Council carried out the connections from the mains to the lamps, the price for lighting would be 1½d. per lamp per week less. It was decided to accept estimate (*b*), if the Company would agree to a three years' contract, instead of five.

Oldham and Gas-Stove Charges.—Since the close of the coal strike, there has been an exceptional demand for gas-stoves in the Oldham area; and at the last meeting of the Gas Committee, Mr. Arthur Andrew, the General Manager, recommended that, in order to ensure that applications are *bonâ fide*, and that the stoves are required for regular use, a charge should be made for them. The Committee decided that 7s. should be the charge for large stoves, 6s. for the intermediate size, and 5s. for small ones. At last Wednesday's meeting of the Council, objection was raised to this minute by Alderman Horrobin, who reminded the members that for years gas-stoves had been supplied free, with the result that there were now 20,000 in use in the borough, and applications in hand for 800 more. In his opinion, it would be a mistake to revert to the old order, and charge for stoves. Alderman Wilde, the Chairman of the Gas Committee, explained that many people wanted stoves merely for use in the summer months; and a small charge was, in the opinion of the Committee, necessary. This department cost £1831 per annum; and the proposed charge would bring in about £1000. An amendment that the minute relating to the charge for cookers be referred back was defeated; and the proceedings of the Committee were then confirmed.

Paris Gas Supply Last Year.—The total quantity of gas sent from the Paris Gas-Works last year was 452,545,014 cubic metres, of which 31,978,617 cubic metres were used for public lighting, and 396,487,356 cubic metres for private lighting; making a total of 428,465,973 cubic metres (15,124,849,000 cubic feet) accounted for, compared with 422,592,587 cubic metres (14,917,518,000 cubic feet) for 1910—an increase of 5,873,386 cubic metres, or 207,331,000 cubic feet. The revenue was 83,791,151 frs. (£3,351,646), compared with 82,628,255 frs. £3,305,130) in 1910; being an increase of 1,162,896 frs. (£46,516).

The Brighouse Town Council at a recent meeting decided that an all-round fixed discount of 2d. in the shilling should be allowed to the users of prepayment meters; the rebate to be paid when the meter is cleared.

A highly successful gas exhibition has been held under the auspices of the Haverton Hill-on-Tees Gas Company, Limited; the exhibitors being the Davis Gas-Stove Company and Messrs. Wilsons and Mathiesons. We learn from the Secretary (Mr. J. W. Dunn) that the exhibition was accompanied by a series of free cookery lectures and practical demonstrations by Mrs. M. Dunn, of Newcastle; and these were much appreciated. The exhibition remained open from May 29 till last Friday.

APPLICATIONS FOR LETTERS PATENT.

12,561.—Slaby, R., "Valveless gas-engine." May 28.

12,562-3.—Oligny, J. D., "Obtaining gas from peat, oil, sawdust, or like material." May 28.

12,601.—Roots, J. D., "Gas-producers." A communication from P. A. Van Herpe. May 28.

12,635.—Anderson, W., Meikle, J., and Fulton, C. W., "Gas-producers." May 29.

12,636.—Hislop, G. R., "Burners." May 29.

12,650.—Fletcher, Russell, and Co., Ltd., and Fletcher, T. W., "Cooking-ranges." May 29.

12,675.—Hunt, P. C. H., and Tipper, F. J., "Retort." May 29.

12,685.—Smart, W. S., and Ward, C. W., "Hinges for gas-tight doors." May 29.

12,720.—Davidson, W. B., "Illuminating, coke-oven, and other gases." May 30.

12,732.—Anderson, H., "Gas-lighters." May 30.

12,796.—Still, W. M., and Sons, Ltd., Adamson, A. G., and Kitson, A. J. D., "Vapour-burning lamps." May 30.

12,832.—Stephens, C., "Burner-tubes." May 31.

12,845.—Johnson, J. Y., "Manufacture of sulphate of ammonia." A communication from the Badische Anilin und Soda Fabrik. May 31.

12,919.—Spreadbury, R. J., "Bye-passes." June 1.

THE INSTITUTION
of interchangeability in cooker parts

does away with the inconvenience, delay, and expense occasioned when renewals are required. This point is impressed upon those who have to deal with cookers made in the ordinary way, by the trouble they have. In the

"SUPER-ACME"

all parts are standardized and are not nominally but **actually** interchangeable.

OTHER NOTABLE FEATURES.

Extra large oven.
Stove built up on separate base.
Gas rail in front.
Hinged and improved hotplate.
Wrought-iron top-bars.
Porcelain-enamelled exterior.
Porcelain-enamelled inside, including door-plate, free from all screws, bolts, and nuts.
Increased space behind oven gates, ensuring perfect ventilation and uniform heat.
Nozzle outlet at back, leaving clear space on top of oven for loose enamelled tray.

ARDEN HILL & CO.,
ACME WORKS,
STON, BIRMINGHAM.

460.

The Belfast Borough Council have adopted a recommendation of the Gas Committee to accept the tender of Messrs. Robert Dempster and Sons, of Elland, at £5500, to supply and erect electric telpher coke-handling plant.

The wages of the workmen employed at the gas-works of the Oldbury Urban District Council have been considered, and increases granted amounting to about £120 a year. The last revision of wages was made about nineteen years ago.

The Town Clerk of Leigh has received from the Local Government Board sanction to the Corporation's application to borrow for the purposes of the gas undertaking the following sums: Mains and services, thirty years, £3630; meters, ten years, £3370.

Mr. J. W. Slack, who has been Secretary of the Richmond Gas Stove and Meter Company for over ten years, and who previously represented the Company in the South of England, has been elected a Director of the Company, but will still continue the secretarial duties.

A disastrous fire, resulting in almost complete destruction of the premises, occurred about two o'clock last Sunday morning at the Picture Palace, Frogmoor, High Wycombe. The cause of the outbreak is not definitely known, but is believed to be the fusing of electric wires.

The Newton (Lancashire) District Council have confirmed a resolution of the Staff Committee to the effect that an application on the part of the stokers employed at the gas-works for an alteration in their rate of pay, together with a week's holiday per year and full pay, be not entertained. Reports from other towns were submitted, showing that, as to wages and conditions of labour, the gas stokers at the Newton works are better situated than most of their fellows.

An interesting feature of the Polytechnic Harriers Sports Festival held at Stamford Bridge Grounds on Saturday, the 1st inst., was the one-mile relay race for the Quintin Hogg Memorial Trophy, which was won in record time by the Polytechnic Harriers. This trophy (a solid silver cup) was presented by Mr. W. Edgar, of Hammersmith, who is a prominent member of the Institution, and accepted by the Amateur Athletic Association to be competed for annually.

We learn that the progress of the Horstmann gas controllers has been so marked during the past six months that the increased facilities which the Company now possess at their new factory in Walcot Street, Bath, have been taxed to the utmost. Numerous orders have been received from such important places as Aldershot, Brentford, Cheadle and Gatley, Dublin, Dundee, Saffron Walden, Salford, Slough, Wincanton, Worthing, Wrexham, Isle of Wight, &c., in this country; and the extent of the Company's foreign business may be gauged by the fact that from one client alone in Australia orders for no less than 4000 of the Type No. 3 controllers have come to hand within the last twelve months. Quantity orders received for North and South America, France, Germany, and Holland have contributed towards the increased output. This has necessitated a further extension of the factory and staff, in anticipation of an extremely busy coming lighting season.

Criticism has been offered at Torquay of the recent decision of the Corporation to spend £400 in installing electrical cooking apparatus at the new Pavilion which has been built there. It has been pointed out that the capital expenditure is higher than would be required for gas-stoves, and that the cost of working will be considerably more. The Torquay Gas Company, in advertisements in the local papers, point out that for cooking, as well as for lighting and heating, gas is very much cheaper than electricity; and they add: "Whatever it can be claimed that electricity will do, we can do better with gas." The matter was referred to by Mr. Williams, the Chairman of the Pavilion Committee, at the meeting of the Town Council last Tuesday. He explained that the expenditure was to be £385, and that this would include, not only the cooking apparatus, but certain other requisites for the kitchen. "The Torquay Directory" remarks, however, that the real point at issued was ignored. This is that gas would be a cheaper agency than electricity for the pavilion kitchen. "The answer of the Committee probably would be that the electrical works are the property of the Corporation, while the gas-works are a private undertaking, and that, even if the electricity will cost more than gas, the Corporation will be its own customer, instead of the customer of a firm. But is this the right attitude to adopt?"

GAS COMPANIES' STOCK AND SHARE LIST.

The Stock Exchange has had anything but a happy week. Several factors combined to produce depression, and it would be hard to find a single quarter to shed a ray of relief. The dangerous positions created by over speculation were not yet fully cleared, and liquidation proceeded persistently. The labour unrest was disquieting—all the more so for Mr. McKenna's recent amazing utterances in the House. Government securities were in the worst odour; and on Friday Consols touched the lowest price marked for many a year. The week closed in gloom. It had opened with a brave show of determination to be cheerful, but the fire soon died out. The announcement of another failure—albeit small—was not calculated to embolden; and Railway prices slipped back, though Government issues held fast. Things on Tuesday were much the same; the start being better than the finish. Consols were not supported, and closed weak. Rails were rather shy; but Americans picked up a bit. Business on Wednesday—as on other Derby Days—was quiet; and markets in general were weak. Consols had a further fall, and Rails were dejected by persistent sales. Thursday was sensitive; and most things were dull. Consols kept on falling; and Rails closed lower. Americans were the best market. Friday was greatly depressed by continued realizations. Consols touched 76$\frac{3}{16}$, from which point they had a slight rebound, Rails gave way completely, and even Americans were quite weak. Saturday was dull and disheartened; Rails being still under the influences above referred to. Consols closed at 76$\frac{3}{8}$ to 76$\frac{5}{8}$ *ex div.* In the Money Market, movements were irregular; the tendency at the close being firm. Business in the Gas Market was rather quieter, and did not present any novel feature; the most gratifying characteristic being the general firmness of the market. Changes in quotation were very few. In Gaslight and Coke issues, the ordinary was very moderately dealt in at narrow figures—only ranging from 104 to 104$\frac{1}{2}$—and the quotation was advanced $\frac{1}{2}$. In the secured issues, the maximum realized 85$\frac{1}{2}$, the preference from 102$\frac{1}{2}$ special to 103, and the debenture 79$\frac{1}{2}$ and 80. South Metropolitan was quiet, and changed hands at 119 to 120$\frac{1}{2}$. The debenture made 78$\frac{3}{4}$. In Commercials, the 4 per cent. was done at 108$\frac{1}{2}$, and the 3$\frac{1}{2}$ per cent. at 105. Among the Suburban and Provincial group, British was marked at 45$\frac{5}{8}$ and 45$\frac{1}{4}$, Brentford debenture at 97$\frac{1}{2}$, South Suburban at 122$\frac{1}{2}$, Wandsworth and Putney at 141$\frac{1}{4}$, and (on the local Exchange) Liverpool "A" at 220. Rises in price were marked in South Suburban debenture and Tottenham and Edmonton "B." In the Continental companies, Imperial was weaker at 186$\frac{1}{4}$ to 183$\frac{1}{2}$ (a fall of 1$\frac{1}{2}$), ditto debenture fetched 88$\frac{1}{2}$, Union from 83$\frac{1}{32}$ to 84 (a rise of 1), and European 19$\frac{3}{4}$. Among the undertakings of the remoter world, Bombay was done at 6$\frac{3}{8}$, Cape Town at 2, Hong Kong at 17, Monte Video at 11$\frac{5}{8}$ and 11$\frac{3}{4}$, Oriental at 136, Primitiva at 7 to 7$\frac{3}{16}$, ditto preference at 5$\frac{3}{16}$ to 5$\frac{5}{16}$, ditto debenture at 95 to 97, and San Paulo preference at 12$\frac{1}{8}$.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	Apl. 12	5	Alliance & Dublin Ord.	72—77	..	6 9 10
374,000	Stk.	Jan. 12	4	Do. 4 p.c. Deb.	91—93	..	4 6 0
250,000	5	Apl. 12	7½	Bombay, Ltd.	6—6¾	..	5 15 5
50,000	10	Feb. 29	15	Bourne-) 10 p.c.	28¼—29½	..	5 1 8
332,000	10	,,	7	mouth Gas) B 7 p.c.	16—16½	..	4 4 10
75,000	10	,,	6	and Water) Pref. 6 p.c.	14¼—14¾	..	4 1 4
380,000	Stk.	,,	13	Brentford Consolidated	258—263	..	4 18 10
330,000	,,	,,	10	Do. New	196—201	..	4 19 6
50,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
206,250	,,	Dec. 14	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
219,055	Stk.	Feb. 29	11	Brighton & Hove Orig.	215—220	..	5 0 0
244,200	,,	,,	8	Do. A Ord. Stk.	156—159	..	5 0 8
490,000	20	Mar. 28	12½	British	44¼—45½	..	5 9 11
120,000	Stk.	Dec. 29	4	Do. 4 p.c. Deb. Stk.	93—95	..	4 4 3
103,000	,,	Feb. 15	6	Bromley, A 5 p.c.	128—133	..	4 10 3
165,700	,,	,,	4½	Do. B 3½ p.c.	98—101	..	4 9 1
82,278	,,	,,	5½	Do. C 5 p.c.	117—120	..	4 11 8
65,000	,,	Dec. 29	3½	Do. 3½ p.c. Deb.	80—82	..	4 5 4
250,000	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	95—97	..	4 2 6
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4—5	..	—
100,000	Stk.	Dec. 29	4½	Do. 4½ p.c. Deb. Stk.	76—80	..	5 12 6
157,150	Stk.	Feb. 15	5	Chester 5 p.c. Ord.	110—112	..	4 9 3
1,513,280	Stk.	Feb. 29	5/9/4	Commercial 4 p.c. Stk.	108—110	..	4 19 4
560,000	,,	,,	5½	Do. 3½ p.c. do.	103—105	..	5 1 6
475,000	,,	Dec. 14	3	Do. 3 p.c. Deb. Stk.	75—77	..	3 17 11
800,000	Stk.	May 31	4	Continental Union, Ltd.	82—85*	+1	4 14 2
200,000	,,	,,	7	Do. 7 p.c. Pref.	133—135*	..	5 3 8
492,270	Stk.	—	5½	Derby Con. Stk.	122—124	..	4 8 9
55,000	,,	—	4	Do. Deb. Stk.	104—105	..	3 16 2
840,150	10	Jan. 31	10	European, Ltd.	19½—20½	..	4 17 7
13,160,600	Stk.	Feb. 15	4/14/8	Gas-) 4 p.c. Ord.	104—106	+½	4 9 3
2,600,000	,,	,,	3½	light) 3½ p.c. max.	84½—86½	..	4 0 11
4,062,235	,,	,,	4	and) 4 p.c. Con. Pref.	102—104	..	3 16 11
4,531,705	,,	Dec. 14	3	Coke) 3 p.c. Con. Deb.	78—80	..	3 15 0
258,740	Stk.	Mar. 14	5	Hastings & St. L. 3½ p.c.	93—95	..	5 5 3
82,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	16½—17	..	6 9 5
191,000	Stk.	Mar. 14	7½	Ilford A and C	155—158	..	4 14 11
65,780	,,	,,	6	Do. B	123—125	..	4 16 0
65,500	,,	Dec. 29	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
4,940,060	Stk.	May 15	9	Imperial Continental	183—187	−1½	4 16 3
1,235,000	Stk.	Feb. 15	3½	Do. 3½ p.c. Deb. Red.	88—90	..	3 17 9

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
200,242	Stk.	Mar. 14	6	Lea Bridge Ord. 5 p.c.	125—129	..	4 13 0
561,000	Stk.	Feb. 29	10	Liverpool United A.	219½—221½	..	4 10 3
718,100	,,	,,	7	Do. B.	158—160	..	4 7 6
306,083	,,	Dec. 29	4	Do. Deb. Stk.	100—102	..	3 18 5
75,000	5	Dec. 14	6	Malta & Mediterranean	4¾—5	..	6 0 0
560,000	100	Apl. 1	5	Met. of) 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne) 4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	May 31	3½	Monte Video, Ltd.	11½—12*	..	5 16 8
1,775,892	Stk.	Feb. 15	4½	Newc'tle&G'tesh'd Con.	99—101	..	4 6 8
529,705	Stk.	Dec. 29	3½	Do. 3½ p.c. Deb.	86—88	..	3 19 7
55,940	10	Feb. 29	7/7/0	North Middlesex 7 p.c.	14—15	..	4 18 0
300,000	Stk.	May 15	8	Oriental, Ltd.	134—136	..	5 17 8
60,000	5	Mar. 14	8	Ottoman, Ltd.	7—7½	..	5 6 8
31,800	53	Feb. 29	13	Portsea Island A	137—140	..	4 18 4
60,000	50	,,	13	Do. B	130—133	..	4 17 9
100,000	50	,,	12	Do. C	127—130	..	4 12 4
398,490	5	May 15	8	Primitiva Ord.	7—7¼	..	5 10 4
796,980	5	Dec. 29	5	Do. 5 p.c. Pref.	5½—5⅝	..	4 13 0
488,900	100	June 1	4	Do. 4 p.c. Deb.	95—97*	..	4 2 6
312,650	Stk.	Dec. 29	4	River Plate 4 p.c. Deb.	95—97	..	4 2 6
275,000	5	Apl. 12	12	San Paulo, Ltd.	11¼—11⅝	..	5 2 2
150,000	10	,,	6	Do. 6 p.c. Pref.	11⅞—12¼	..	4 18 0
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	50—51	..	4 18 0
135,000	Stk.	Mar. 14	10	Sheffield A	235—237	..	4 4 5
209,984	,,	,,	10	Do. B	234—236	..	4 4 9
523,500	,,	,,	10	Do. C	234—236	..	4 4 9
90,000	10	May 31	7½	South African	7⅞—8½*	..	8 16 6
6,429,895	Stk.	Feb. 15	5/9/4	South Met., 4 p.c. Ord.	119—121	..	4 10 6
1,895,445	,,	Jan. 12	3	Do. 3 p.c. Deb.	78—80	..	3 15 0
209,820	Stk.	Feb. 29	8½	South Shields Con. Stk.	156—158	..	5 7 7
605,000	Stk.	Feb. 15	5/16/8	S'th Suburb'n Ord. 5 p.c.	122—124	..	4 14 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	,,	Jan. 12	5	Do. 5 p.c. Deb. Stk.	120—122	+1	4 2 0
502,310	Stk.	May 15	5	Southampton Ord.	105—107	..	4 13 6
120,000	Stk.	Feb. 15	7½	Tottenham) A 5 p.c.	144—147	..	4 17 0
483,940	,,	,,	5⅝	and) B 3½ p.c.	116—118	+2	4 15 4
149,470	,,	Dec. 29	4	Edmonton) 4 p.c. Deb.	96—98	..	4 1 8
182,380	10	,,	5	Tuscan, Ltd.	8⅝—8¾	..	5 12 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
236,476	Stk.	Feb. 29	5	Tynemouth, 5 p.c. max.	112—114	..	4 7 9
255,636	Stk.	,,	6⅞	Wands-) B 3½ p.c.	141—144	..	4 15 6
85,766	,,	Dec. 29	3	worth) 3 p.c. Deb. Stk.	71½—73½	..	4 1 8

Prices Marked * are "Ex Div."